DES-3226
Managed 24-Port NWay Standalone Fast Ethernet Switch
User's Guide

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RECYCLABLE

Wichtige Sicherheitshinweise

1. Bitte lesen Sie sich diese Hinweise sorgfältig durch.
2. Heben Sie diese Anleitung für den spätern Gebrauch auf.
3. Vor jedem Reinigen ist das Gerät vom Stromnetz zu trennen. Vervenden Sie keine Flüssig- oder Aerosolreiniger. Am besten dient ein angefeuchtetes Tuch zur Reinigung.
4. Um eine Beschädigung des Gerätes zu vermeiden sollten Sie nur Zubehörteile verwenden, die vom Hersteller zugelassen sind.
5. Das Gerät is vor Feuchtigkeit zu schützen.
6. Bei der Aufstellung des Gerätes ist auf sichern Stand zu achten. Ein Kippen oder Fallen könnte Verletzungen hervorrufen. Verwenden Sie nur sichere Standorte und beachten Sie die Aufstellhinweise des Herstellers.
7. Die Belüftungsöffnungen dienen zur Luftzirkulation die das Gerät vor Überhitzung schützt. Sorgen Sie dafür, daß diese Öffnungen nicht abgedeckt werden.
8. Beachten Sie beim Anschluß an das Stromnetz die Anschlußwerte.
9. Die Netzanschlußsteckdose muß aus Gründen der elektrischen Sicherheit einen Schutzleiterkontakt haben.
10. Verlegen Sie die Netzanschlußleitung so, daß niemand darüber fallen kann. Es sollete auch nichts auf der Leitung abgestellt werden.
11. Alle Hinweise und Warnungen die sich am Geräten befinden sind zu beachten.
12. Wird das Gerät über einen längeren Zeitraum nicht benutzt, sollten Sie es vom Stromnetz trennen. Somit wird im Falle einer Überspannung eine Beschädigung vermieden.
13. Durch die Lüftungsöffnungen dürfen niemals Gegenstände oder Flüssigkeiten in das Gerät gelangen. Dies könnte einen Brand bzw. Elektrischen Schlag auslösen.
14. Öffnen Sie niemals das Gerät. Das Gerät darf aus Gründen der elektrischen Sicherheit nur von authorisiertem Servicepersonal geöffnet werden.
15. Wenn folgende Situationen auftreten ist das Gerät vom Stromnetz zu trennen und von einer qualifizierten Servicestelle zu überprüfen:
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    b – Flüssigkeit ist in das Gerät eingedrungen.
    c – Das Gerät war Feuchtigkeit ausgesetzt.
    d – Wenn das Gerät nicht der Bedienungsanleitung ensprechend funktioniert oder Sie mit Hilfe dieser Anleitung keine Verbesserung erzielen.
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18. Zum Netzanschluß dieses Gerätes ist eine geprüfte Leitung zu verwenden, Für einen Nennstrom bis 6A und einem Gerätegewicht gr ßer 3kg ist eine Leitung nicht leichter als H05VV-F, 3G, 0.75mm2 einzusetzen.

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This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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Dies ist ein Produkt der Klasse A. Im Wohnbereich kann dieses Produkt Funkstoerungen verursachen. In diesem Fall kann vom Benutzer verlangt werden, angemessene Massnahmen zu ergreifen.

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Este es un producto de Clase A. En un entorno doméstico, puede causar interferencias de radio, en cuyo case, puede requerirse al usuario para que adopte las medidas adecuadas.

Attention!

Ceci est un produit de classe A. Dans un environnement domestique, ce produit pourrait causer des interférences radio, auquel cas l`utilisateur devrait prendre les mesures adéquates.

Attenzione!

Il presente prodotto appartiene alla classe A. Se utilizzato in ambiente domestico il prodotto può causare interferenze radio, nel cui caso è possibile che l`utente debba assumere provvedimenti adeguati.

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ABOUT THIS GUIDE

This User's guide tells you how to install your DES-3226, how to connect it to your Ethernet/Fast Ethernet network, and how to set its configuration using the built-in console interface.

Overview of this User's Guide

- Chapter 1, "*Introduction*." Describes the Switch and its features.
- Chapter 2, "*Unpacking and Setup*." Helps you get started with the basic installation of the Switch.
- Chapter 3, "*Identifying External Components*." Describes the front panel, rear panel, optional plug-in modules, and LED indicators of the Switch.
- Chapter 4, "*Connecting the Switch*." Tells how you can connect the DES-3226 to your Ethernet/Fast Ethernet network.
- Chapter 5, "*Switch Management and Operating Concepts*." Talks about Local Console Management via the RS-232 DCE console port and other aspects about how to manage the Switch.
- Chapter 6, "*Using the Console Interface*." Tells how to use the built-in console interface to change, set, and monitor Switch performance and security.
- Chapter 7, "*Web-Based Network Management*." Tells how to manage the Switch through an Internet browser.
- Appendix A, "*Technical Specifications*." Lists the technical specifications of the DES-3226.
- Appendix B, "*RJ-45 Pin Specifications*." Shows the details and pin assignments for the RJ-45 receptacle/connector.
- Appendix C, "*Factory Default Settings*."
- Appendix D, "*Understanding and Troubleshooting the Spanning Tree Protocol.*"
- Appendix E, "*Brief Review of Bitwise Logical Operations.*"

1

INTRODUCTION

This section describes the features of the DES-3226. Some background information about Ethernet/Fast Ethernet and switching technology is presented. This is intended for readers who may not be familiar with the concepts of layered switching and routing but is not intended to be a complete or in-depth discussion.

Features

The DES-3226 was designed for easy installation and high performance in an environment where traffic on the network and the number of users increases continuously.

Switch features include:

Ports

- 24 high performance NWay (MDI-II/MDI-X) ports for connecting to end stations, servers and hubs. Every port can be used for an uplink connection.
- All UTP ports can auto-negotiate (NWay) between 10Mbps/100Mbps, half-duplex or full duplex, and feature flow control for half-duplex ports.
- One front panel slide-in module interface for a 1-port 100BASE-FX (2Km), 2-port 100BASE-FX (2Km), 1-port 100BASE-FL (15Km), 2-port 100BASE-FL (15Km), 2-port 1000BASE-SX, 2-port 1000BASE-LX, 2-port 1000BASE-T, or 2-port GBIC to connect to another switch, server or network backbone.
- RS-232 DCE Diagnostic port (console port) for setting up and managing the Switch via a connection to a console terminal or PC using a terminal emulation program.

Performance Features

- 8.8 Gbps switching fabric capacity
- Store and forward switching scheme.
- Full and half-duplex for both 10Mbps and 100Mbps connections. Full duplex allows the switch port to simultaneously transmit and receive data, and only works with connections to full-duplex capable end stations and switches. Connections to hubs must take place at half duplex.
- Supports IEEE 802.3x flow control for full-duplex mode ports.
- Supports Back-pressure flow control for half-duplex mode ports.
- Auto-polarity detection and correction of incorrect polarity on the transmit and receive twisted-pair at each port.

- Data forwarding rate 14,880 pps per port at 100% of wire-speed for 10Mbps speed.
- Data forwarding rate 148,800 pps per port at 100% of wire-speed for 100Mbps speed.
- Data filtering rate eliminates all error packets, runts, etc. at 14,880 pps per port at 100% of wire-speed for 10Mbps speed.
- Data filtering rate eliminates all error packets, runts, etc. at 148,800 pps per port at 100% of wire-speed for 100Mbps speed.
- 8K active MAC address entry table per device with automatic learning and aging (10 to 1000000 seconds).
- 8 MB packet buffer per device.
- 802.1D Spanning Tree support.
- 802.1Q Tagged VLAN support, including GVRP (GARP VLAN Registration Protocol) support for automatic VLAN configuration distribution. All the supported VLANs (including dynamic joined VLANs by GVRP and user-defined VLANs and the one reserved VLAN) can be up to 255.
- IGMP Snooping support.
- Port trunking support.

Management

- RS-232 console port for out-of-band network management via a console terminal.
- Spanning Tree Algorithm Protocol for creation of alternative backup paths and prevention of network loops.
- SNMP v.1 Agent.
- Fully configurable either in-band or out-of-band control via SNMP based software.
- Flash memory for software upgrades. This can be done in-band via TFTP or out-of-band via the console.
- Built-in SNMP management:
    - Bridge MIB (RFC 1493)
    - MIB-II (RFC 1213)
    - Mini-RMON MIB (RFC 1757) – 4 groups
    - 802.1p MIB (RFC 2674)
    - 802.1q MIB (RFC 2674)
    - Entity MIB (RFC 2737)
    - IF-MIB (RFC 2233)
    - Ether-Like MIB (RFC2358) –dot3StatsTable
    - Enterprise MIB
- Supports Web-based management.
- TFTP support.
- BOOTP support.

- DHCP Client support.
- Password enabled.
- Telnet remote control console.

Fast Ethernet Technology

100Mbps Fast Ethernet (or 100BASE-T) is a standard specified by the IEEE 802.3 LAN committee. It is an extension of the 10Mbps Ethernet standard with the ability to transmit and receive data at 100Mbps, while maintaining the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Ethernet protocol.

2

UNPACKING AND SETUP

This chapter provides unpacking and setup information for the Switch.

Unpacking

Open the shipping carton of the Switch and carefully unpack its contents. The carton should contain the following items:

- One DES-3226 24-Port NWay Standalone Fast Ethernet Switch
- Mounting kit: 2 mounting brackets and screws
- Four rubber feet with adhesive backing
- One AC power cord
- This User's Guide with Registration Card

If any item is found missing or damaged, please contact your local reseller for replacement.

Installation

Use the following guidelines when choosing a place to install the Switch:

- The surface must support at least 3 kg.
- The power outlet should be within 1.82 meters (6 feet) of the device.
- Visually inspect the power cord and see that it is secured to the AC power connector.
- Make sure that there is proper heat dissipation from and adequate ventilation around the Switch. Do not place heavy objects on the Switch.

Desktop or Shelf Installation

When installing the Switch on a desktop or shelf, the rubber feet included with the device should first be attached. Attach these cushioning feet on the bottom at each corner of the device. Allow adequate space for ventilation between the device and the objects around it.

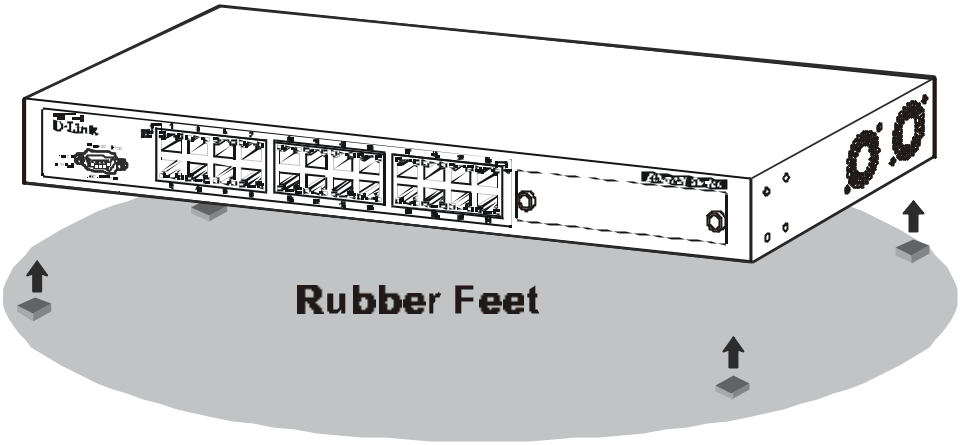


Figure 2-1. Installing rubber feet for desktop installation

Rack Installation

The DES-3226 can be mounted in an EIA standard-sized, 19-inch rack, which can be placed in a wiring closet with other equipment. To install, attach the mounting brackets on the Switch's side panels (one on each side) and secure them with the screws provided.

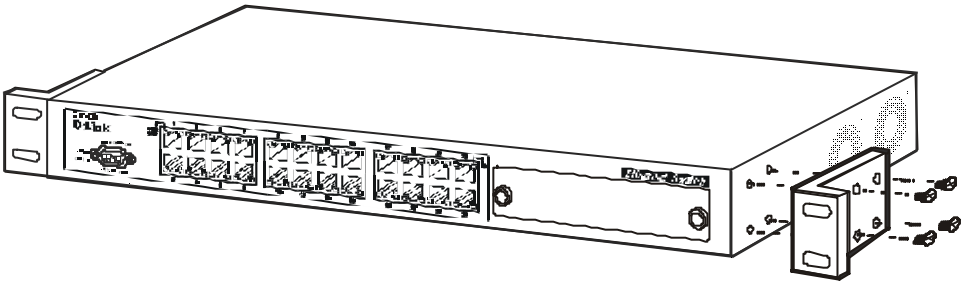


Figure 2- 2A. Attaching the mounting brackets to the Switch

Then, use the screws provided with the equipment rack to mount the Switch on the rack.

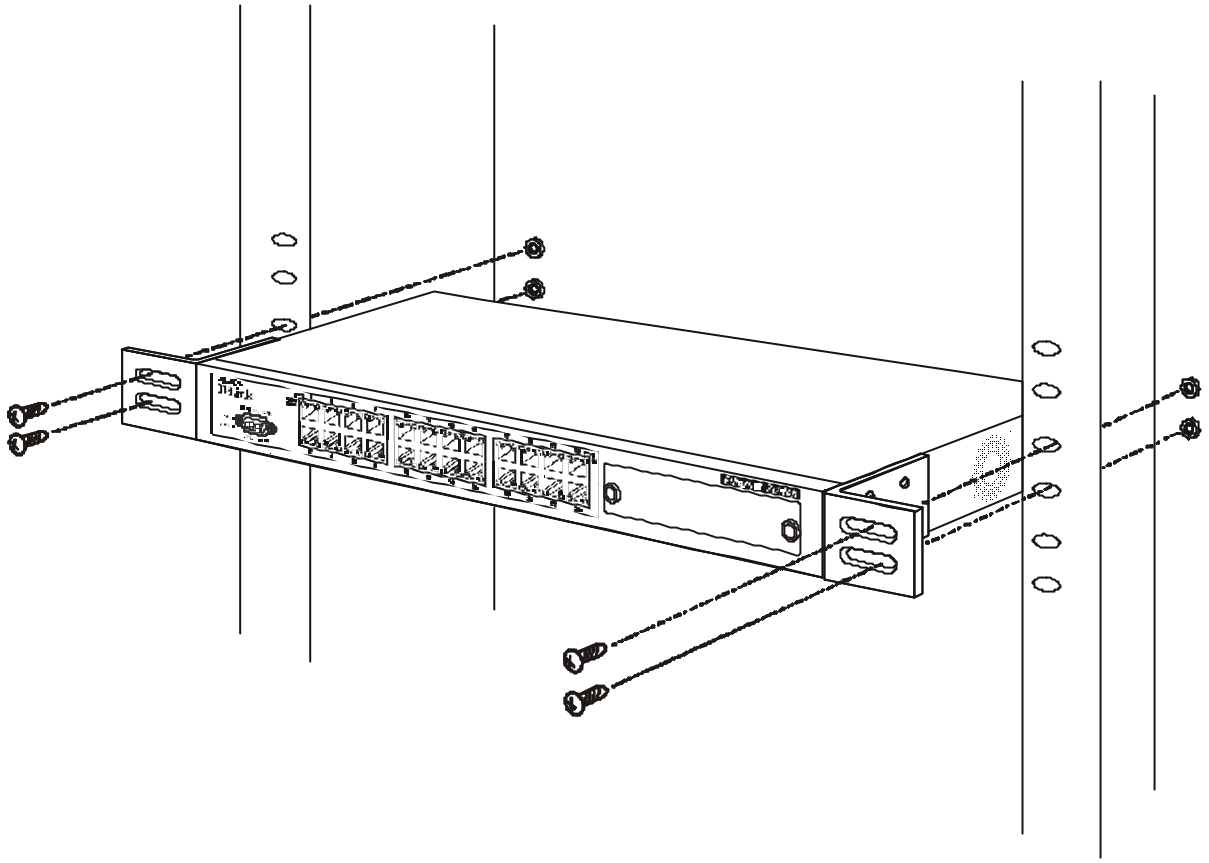


Figure 2-2B. Installing the Switch in an equipment rack

Power on

The Switch can be used with AC power supply 100-240 VAC, 50 - 60 Hz. The Switch's power supply will adjust to the local power source automatically and may be powered on without having any or all LAN segment cables connected.

After the Switch is plugged in, the LED indicators should respond as follows:

- All LED indicators will momentarily blink. This blinking of the LED indicators represents a reset of the system.
- The power LED indicator will blink while the Switch loads onboard software and performs a self-test. After approximately 20 seconds, the LED will light again to indicate the switch is in a ready state.

Power Failure

As a precaution in the event of a power failure, unplug the Switch. When power is resumed, plug the Switch back in.

3

IDENTIFYING EXTERNAL COMPONENTS

This chapter describes the front panel, rear panel, side panels, optional plug-in modules, and LED indicators of the DES-3226.

Front Panel

The front panel of the Switch consists of LED indicators, an RS-232 communication port, a slide-in module slot, and 24 MDI-X/MDI-II Ethernet/Fast Ethernet (10/100 Mbps) ports, each of which is capable of making an uplink connection.

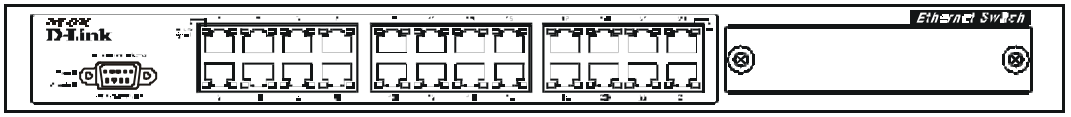


Figure 3-1. Front panel view of the Switch

- Comprehensive LED indicators display the status of the Switch and the network (see the *LED Indicators* section below).
- An RS-232 DCE console port for setting up and managing the Switch via a connection to a console terminal or PC using a terminal emulation program.
- A front-panel slide-in module slot can accommodate a 1-port 100BASE-FX (2Km), 2-port 100BASE-FX (2Km), 1-port 100BASE-FL (15Km), 2-port 100BASE-FL (15Km), 2-port 1000BASE-SX, 2-port 1000BASE-LX, 2-port 1000BASE-T, or 2-port GBIC module to connect to another switch, server or network backbone.
- Twenty-four high-performance, NWay Ethernet ports all of which operate at 10/100 Mbps for connections to end stations, servers and hubs. All ports can auto-negotiate between 10Mbps or 100Mbps, full or half duplex, and feature flow control.

Rear Panel

The rear panel of the Switch contains an AC power connector.

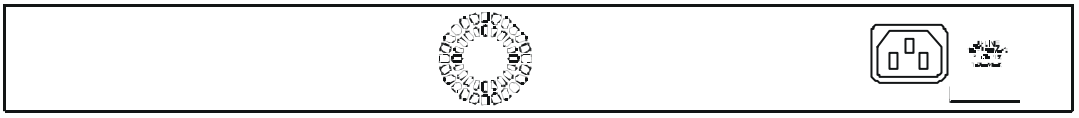


Figure 3-2. Rear panel view of the Switch

- The AC power connector is a standard three-pronged connector that supports the power cord. Plug-in the female connector of the provided power cord into this socket, and the male side of the cord into a power outlet. Supported input voltages range from 100 ~ 240 VAC at 50 ~ 60 Hz.

Side Panels

The right side panel of the Switch contains two system fans (see the top part of the diagram below). The left side panel contains heat vents.

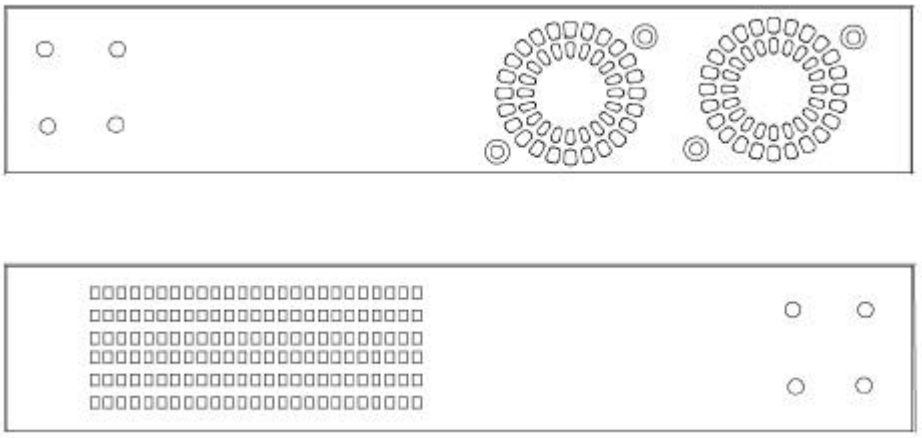


Figure 3-3. Side panel views of the Switch

- The system fans are used to dissipate heat. The sides of the system also provide heat vents to serve the same purpose. Do not block these openings, and leave at least 6 inches of space at the rear and sides of the switch for proper ventilation. Be reminded that without proper heat dissipation and air circulation, system components might overheat, which could lead to system failure.

Optional 100BASE and 1000BASE Extension Modules

The Switch is able to accommodate a range of optional plug-in modules in order to increase functionality and performance. These modules must be purchased separately.

100BASE-FX Module (2Km)

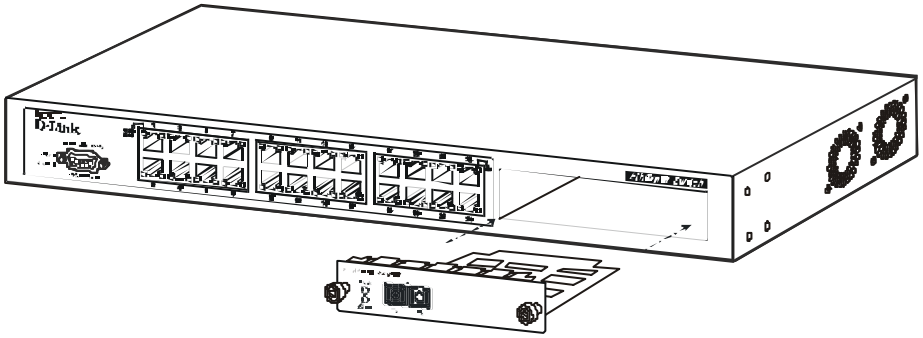


Figure 3-4. Optional 100BASE 1-port front panel module

- One 100BASE-FX (with SC type connector) Fiber port.
- Fully compliant with IEEE802.3u.
- Support Full-duplex operation only.
- IEEE 802.3x compliant Flow Control support for full-duplex.

100BASE-FX Module (2Km)

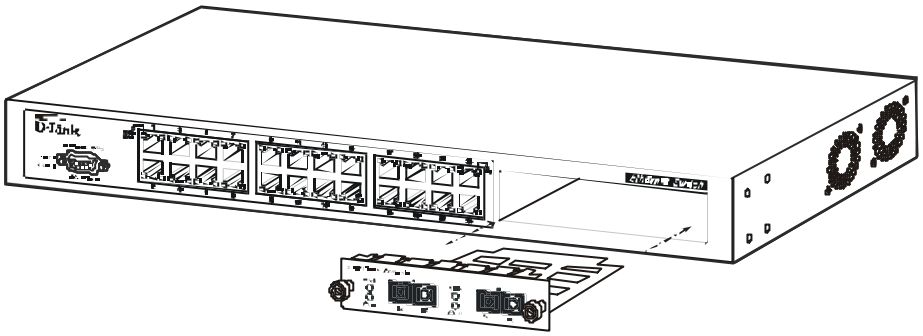


Figure 3-5. Optional 100BASE 2-port front panel module

- Two 100BASE-FX (with SC type connector) Fiber ports.
- Fully compliant with IEEE802.3u.
- Support Full-duplex operation only.
- IEEE 802.3x compliant Flow Control support for full-duplex.

100BASE-FL Module (15Km)

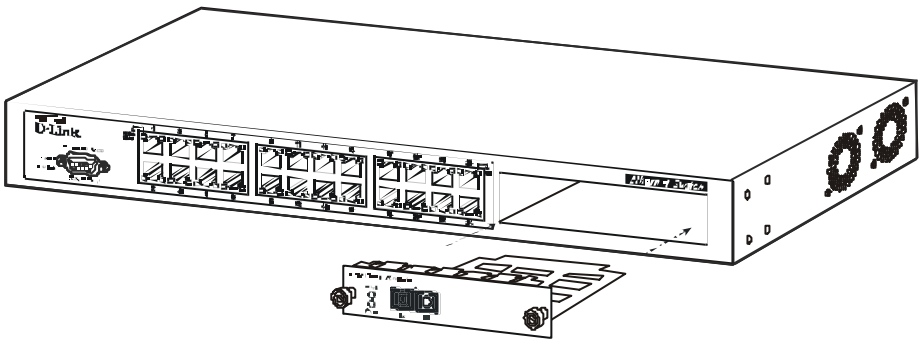


Figure 3-6. Optional 100BASE 1-port front panel module

- One 100BASE-FL (with SC type connector) port.
- Fully compliant with IEEE802.3u.
- Support Full-duplex operation only.
- IEEE 802.3x compliant Flow Control support for full-duplex.

100BASE-FL Module (15Km)

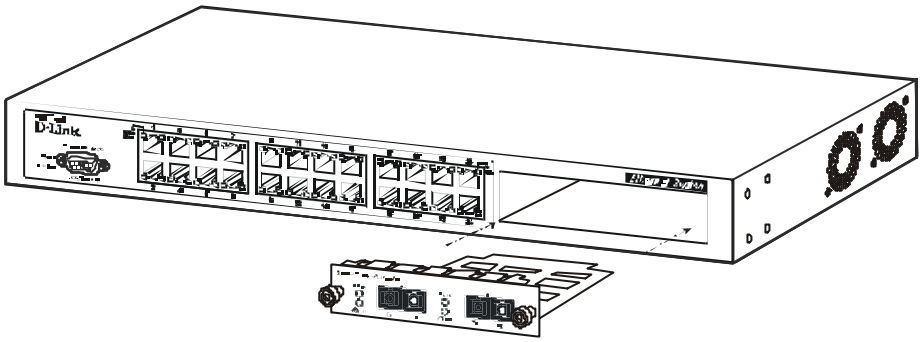


Figure 3-7. Optional 100BASE 2-port front panel module

- Two 100BASE-FL (with SC type connector) ports.
- Fully compliant with IEEE802.3u.
- Support Full-duplex operation only.
- IEEE 802.3x compliant Flow Control support for full-duplex.

1000BASE-LX Gigabit Module

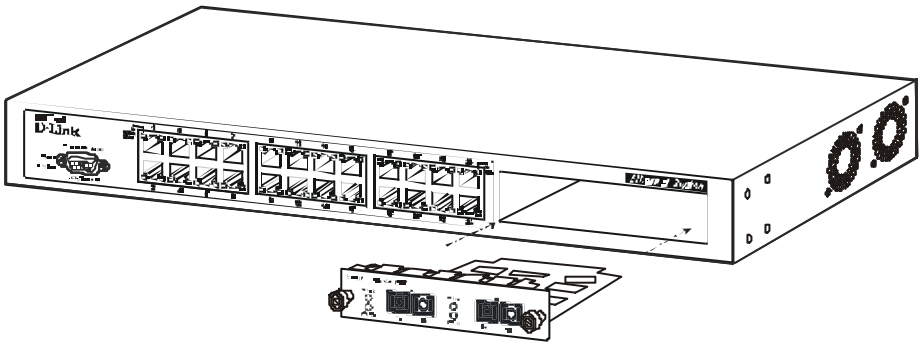


Figure 3-8. Optional 1000BASE-LX 2-port front panel module

- Two 1000BASE-LX ports.
- Connects to 1000BASE-LX devices at full duplex or auto.
- Allows connections up to 5 km in length using single-mode fiber optic cable.

1000BASE-SX Gigabit Module

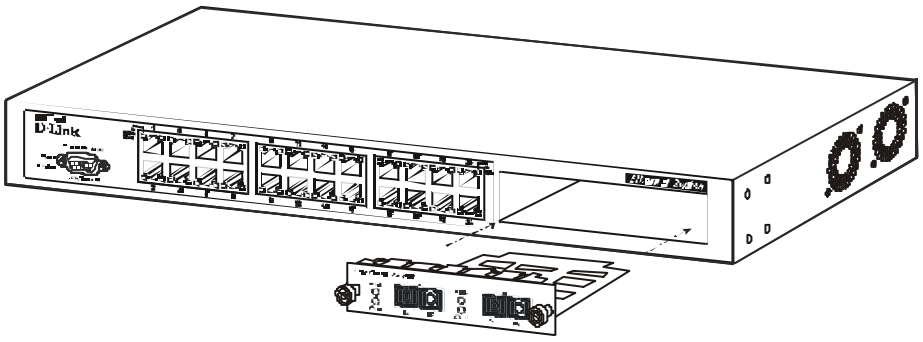


Figure 3-9. Optional 1000BASE-SX 2-port front panel module

- Two 1000BASE-SX ports.
- Connects to 1000BASE-SX devices at full-duplex or auto.
- IEEE 802.3x compliant Flow Control support for full-duplex.
- Supports multi-mode fiber-optic cable connections of up to 2 km.
- Allows connections using multi-mode fiber optic cable in the following configurations:

	62.5㎛	62.5㎛	50㎛	50㎛
Modal bandwidth (min. overfilled launch) Unit: MHz*km	160	200	400	500
Operating distance Unit: meters	220	275	500	550
Channel insertion loss Unit: dB	2.33	2.53	3.25	3.43

1000BASE-T Copper Gigabit Module

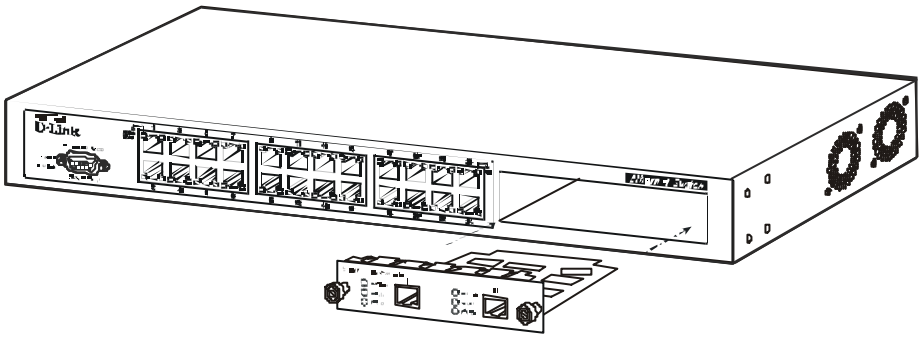


Figure 3-10. Optional 1000BASE-T Copper 2-port front panel module

- Two 1000BASE-T Copper ports.
- Connects to 1000BASE-T devices at 1000M/full duplex, 100M/full duplex, 100M/half duplex, and Auto.
- Supports Category 5+ or higher cable connections of up to 100 meters.

1000BASE GBIC Module

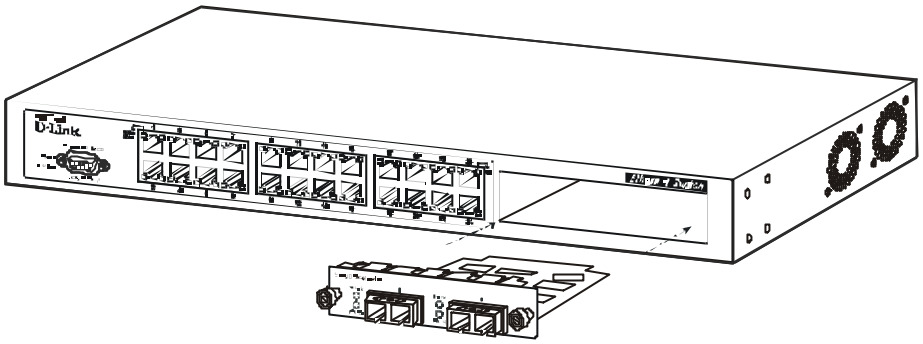


Figure 3-11. Optional 1000BASE GBIC 2-port front panel module

- Two 1000BASE GBIC ports.
- Connects to GBIC devices at full duplex only.
- Allows multi-mode fiber optic cable runs of up to 550m in full-duplex mode (only).

LED Indicators

The LED indicators of the Switch include Power, Console, Speed, and Link/Act. The following shows the LED indicators for the Switch along with an explanation of each indicator.

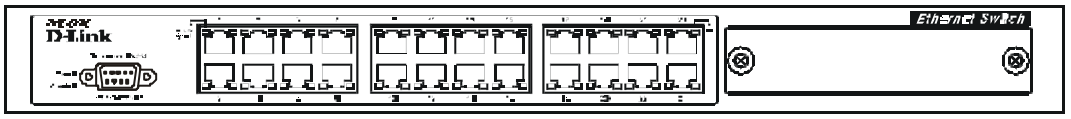


Figure 3-12. The LED indicators

- **Power** – This indicator on the front panel should be lit during the Power-On Self Test (POST). It will light green approximately 2 seconds after the switch is powered on to indicate the ready state of the device.
- **Console** – This indicator is lit green when the Switch is being managed via out-of-band/local console management through the RS-232 console port using a straight-through serial cable.
- **Speed** – On the right of each twisted pair port, this LED will light when the corresponding port is operating at 100 Mbps. An unlit LED indicates a connection speed of 10 Mbps.
- **Act/Link** – These indicators are located to the left of each port. They are lit when there is a secure connection (or link) to a device at any of the ports. The LEDs blink whenever there is reception or transmission (i.e. Activity--Act) of data occurring at a port.

4

CONNECTING THE SWITCH

This chapter describes how to connect the DES-3226 to your Ethernet/Fast Ethernet network.

Switch to End Node

End nodes include PCs outfitted with a 10, 100 or 10/100 Mbps RJ-45 Ethernet/Fast Ethernet Network Interface Card (NIC) and most routers.

An end node can be connected to the Switch via a two-pair Category 3, 4, or 5 UTP/STP cable. The end node should be connected to any of the ports of the Switch.

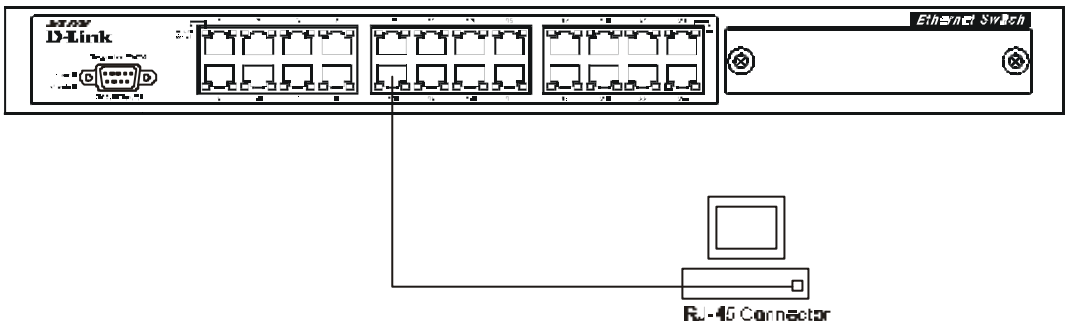


Figure 4-1. Switch connected to an End Node

The **Link/Act** LEDs for each UTP port light green when the link is valid. The LED on the right side of the port indicates port speed. It will light for 100 Mbps connections only. A blinking LED on the left side indicates packet activity on that port.

Switch to Hub or Switch

These connections can be accomplished in a number of ways using a normal cable.

- A 10BASE-T hub or switch can be connected to the Switch via a two-pair Category 3, 4 or 5 UTP/STP cable.
- A 100BASE-TX hub or switch can be connected to the Switch via a two-pair Category 5 UTP/STP cable.

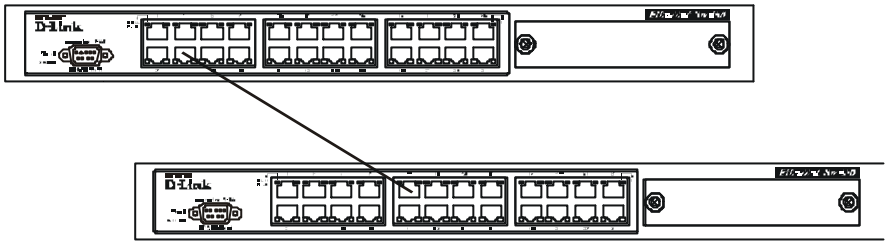


Figure 4-2. Switch connected to a normal (non-Uplink) port on a hub or switch using a straight or crossover cable

5

SWITCH MANAGEMENT AND OPERATING CONCEPTS

This chapter discusses many of the concepts and features used to manage the Switch, as well as the concepts necessary for the user to understand the functioning of the switch. Further, this chapter explains many important points regarding these features.

Configuring the Switch to implement these concepts and make use of its many features is discussed in detail in the next chapters.

Local Console Management

A local console is a terminal or a workstation running a terminal emulation program that is connected directly to the switch via the RS-232 console port on the front of the Switch. A console connection is referred to as an 'Out-of-Band' connection, meaning that console is connected to the Switch using a different circuit than that used for normal network communications. So, the console can be used to set up and manage the Switch even if the network is down.

Local console management uses the terminal connection to operate the console program built-in to the Switch (see Chapter 6, "*Using the Console Interface*"). A network administrator can manage, control and monitor the switch from the console program.

The DES-3226 contains a CPU, memory for data storage, flash memory for configuration data, operational programs, and SNMP agent firmware. These components allow the Switch to be actively managed and monitored from either the console port or the network itself (out-of-band, or in-band).

Diagnostic (console) port (RS-232 DCE)

Out-of-band management requires connecting a terminal, such as a VT-100 or a PC running a terminal emulation program (such as HyperTerminal, which is automatically installed with Microsoft Windows) a to the RS-232 DCE console port of the Switch. Switch management using the RS-232 DCE console port is called *Local Console Management* to differentiate it from management performed via management platforms, such as D-View, HP OpenView, etc.

The console port is set at the factory for the following configuration:

- Baud rate: 9,600
- Data width: 8 bits
- Parity: none
- Stop bits: 1
- Flow Control None

Make sure the terminal or PC you are using to make this connection is configured to match these settings.

If you are having problems making this connection on a PC, make sure the emulation is set to VT-100. If you still don't see anything, try hitting <Ctrl> + r to refresh the screen.

IP Addresses and SNMP Community Names

Each Switch must be assigned its own IP Address, which is used for communication with an SNMP network manager or other TCP/IP application (for example BOOTP, TFTP). The Switch's default IP address is 10.90.90.90. You can change the default Switch IP Address to meet the specification of your networking address scheme.

The Switch is also assigned a unique MAC address by the factory. This MAC address cannot be changed, and can be found from the initial boot console screen – shown below.

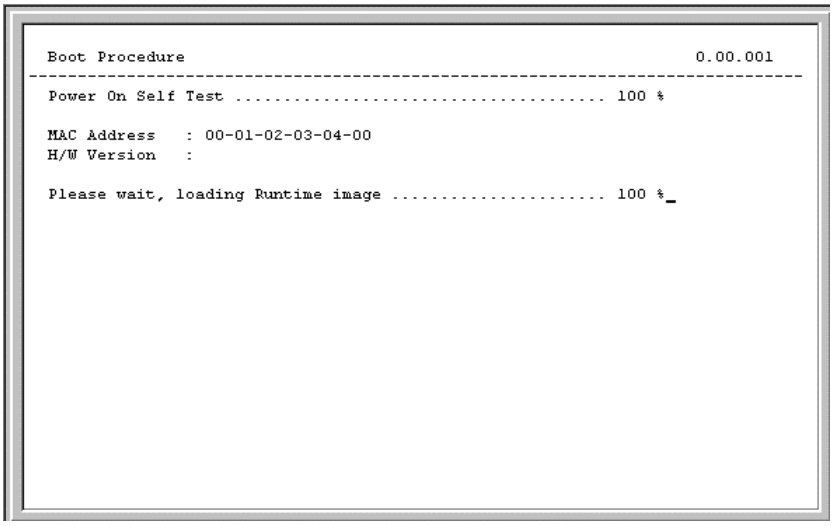

Boot Procedure 0.00.001
Power On Self Test ..... 100 %
MAC Address : 00-01-02-03-04-00
H/W Version :
Please wait, loading Runtime image ..... 100 %

Figure 5-1. Boot Procedure screen

The Switch's MAC address can also be found from the console program under the **Switch Information** menu item, as shown below.

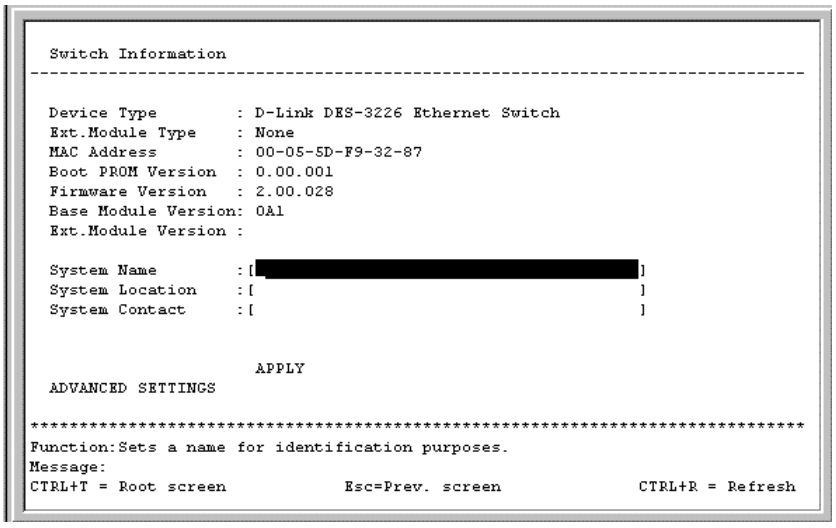

Switch Information
Device Type : D-Link DES-3226 Ethernet Switch
Ext.Module Type : None
MAC Address : 00-05-5D-F9-32-87
Boot PROM Version : 0.00.001
Firmware Version : 2.00.028
Base Module Version: 0A1
Ext.Module Version :
System Name :[ ]
System Location :[ ]
System Contact :[ ]
APPLY
ADVANCED SETTINGS
Function:Sets a name for identification purposes.
Message:
CTRL+T = Root screen Esc=Prev. screen CTRL+R = Refresh

Figure 5-2. Switch Information menu

In addition, you can also set an IP Address for a gateway router. This becomes necessary when the network management station is located on a different IP network from the Switch, making it necessary for management packets to go through a router to reach the network manager, and vice-versa.

For security, you can set in the Switch a list of IP Addresses of the network managers that allow you to manage the Switch. You can also change the default SNMP Community Strings in the Switch and set the access rights of these Community Strings. In addition, a VLAN may be designated as a Management VLAN.

Traps

Traps are messages that alert you of events that occur on the Switch. The events can be as serious as a reboot (someone accidentally turned OFF the Switch), or less serious like a port status change. The Switch generates traps and sends them to the network manager (trap recipient).

Trap recipients are special users of the network who are given certain rights and access in overseeing the maintenance of the network. Trap recipients will receive traps sent from the Switch; they must immediately take certain actions to avoid future failure or breakdown of the network.

You can also specify which network managers may receive traps from the Switch by entering a list of the IP addresses of authorized network managers. Up to four trap recipient IP addresses, and four corresponding SNMP community strings can be entered.

SNMP community strings function like passwords in that the community string entered for a given IP address must be used in the management station software, or a trap will be sent.

The following are trap types the Switch can send to a trap recipient:

- **Cold Start** – This trap signifies that the Switch has been powered up and initialized such that software settings are reconfigured and hardware systems are rebooted. A cold start is different from a factory reset in that configuration settings saved to non-volatile RAM used to reconfigure the switch.
- **Warm Start** – This trap signifies that the Switch has been rebooted, however the POST (Power On Self-Test) is skipped.
- **Authentication Failure** – This trap signifies that someone has tried to logon to the switch using an invalid SNMP community string. The Switch automatically stores the source IP address of the unauthorized user.
- **New Root** – This trap indicates that the Switch has become the new root of the Spanning Tree, the trap is sent by the switch soon after its election as the new root. This implies that upon expiration of the Topology Change Timer the new root trap is sent out immediately after the Switch's election as the new root.
- **Topology Change (STP)** – A Topology Change trap is sent by the Switch when any of its configured ports transitions from the Learning state to the Forwarding state, or from the Forwarding state to the Blocking state. The trap is not sent if a new root trap is sent for the same transition.
- **Link Up** – This trap is sent whenever the link of a port changes from link down to link up.
- **Link Down** – This trap is sent whenever the link of a port changes from link up to link down.

MIBs

Management and counter information are stored in the Switch in the Management Information Base (MIB). The Switch uses the standard MIB-II Management Information Base module. Consequently, values for MIB objects can be retrieved from any SNMP-based network management software. In addition to the standard MIB-II, the Switch also supports its own proprietary enterprise MIB as an extended Management Information Base. These MIBs may also be retrieved by specifying the MIB's Object-Identity (OID) at the network manager. MIB values can be either read-only or read-write.

Read-only MIBs variables can be either constants that are programmed into the Switch, or variables that change while the Switch is in operation. Examples of read-only constants are the number of port and type of ports. Examples of read-only variables are the statistics counters such as the number of errors that have occurred, or how many kilobytes of data have been received and forwarded through a port.

Read-write MIBs are variables usually related to user-customized configurations. Examples of these are the Switch's IP Address, Spanning Tree Algorithm parameters, and port status.

If you use a third-party vendors' SNMP software to manage the Switch, a diskette listing the Switch's propriety enterprise MIBs can be obtained by request. If your software provides functions to browse or modify MIBs, you can also get the MIB values and change them (if the MIBs' attributes permit the write operation). This process however can be quite involved, since you must know the MIB OIDs and retrieve them one by one.

SNMP

The Simple Network Management Protocol (SNMP) is an OSI layer 7 (the application layer) protocol for remotely monitoring and configuring network devices. SNMP enables network management stations to read and modify the settings of gateways, routers, switches, and other network devices. SNMP can be used to perform many of the same functions as a directly connected console, or can be used within an integrated network management software package such as HP OpenView or DView.

SNMP performs the following functions:

- Sending and receiving SNMP packets through the IP protocol.
- Collecting information about the status and current configuration of network devices.
- Modifying the configuration of network devices.

The DES-3226 has a software program called an 'agent' that processes SNMP requests, but the user program that makes the requests and collects the responses runs on a management station (a designated computer on the network). The SNMP agent and the user program both use the UDP/IP protocol to exchange packets.

Authentication

The authentication protocol ensures that both the router SNMP agent and the remote user SNMP application program discard packets from unauthorized users. Authentication is accomplished using 'community strings', which function like passwords. The remote user SNMP application and the router SNMP must use the same community string. SNMP community strings of up to 20 characters may be entered under the **Remote Management Setup** menu of the console program.

Packet Forwarding

The Switch enters the relationship between destination MAC or IP addresses and the Ethernet port or gateway router the destination resides on into its forwarding table. This information is then used to forward packets. This reduces the traffic congestion on the network, because packets, instead of being transmitted to all ports, are transmitted to the destination port only. Example: if Port 1 receives a packet destined for a station on Port 2, the Switch transmits that packet through Port 2 only, and transmits nothing through the other ports. This process is referred to as 'learning' the network topology.

MAC Address Aging Time

The Aging Time affects the learning process of the Switch. Dynamic forwarding table entries, which are made up of the source and destination MAC addresses and their associated port numbers, are deleted from the table if they are not accessed within the aging time.

The aging time can be from 10 to 1,000,000 seconds with a default value of 300 seconds. A very long aging time can result in dynamic forwarding table entries that are out-of-date or no longer exist. This may cause incorrect packet forwarding decisions by the Switch.

If the Aging Time is too short however, many entries may be aged out too soon. This will result in a high percentage of received packets whose source addresses cannot be found in the forwarding table, in which case the switch will broadcast the packet to all ports, negating many of the benefits of having a switch.

Static forwarding entries are not affected by the aging time.

Filtering

The Switch uses a filtering database to segment the network and control communication between segments. It can also filter packets off the network for intrusion control. Static filtering entries can be made by MAC Address or IP Address filtering.

Each port on the Switch is a unique collision domain and the switch filters (discards) packets whose destination lies on the same port as where it originated. This keeps local packets from disrupting communications on other parts of the network.

For intrusion control, whenever a Switch encounters a packet originating from or destined to a MAC address or an IP Address entered into the filter table, the switch will discard the packet.

Some filtering is done automatically by the Switch:

- Dynamic filtering – automatic learning and aging of MAC addresses and their location on the network. Filtering occurs to keep local traffic confined to its segment.
- Filtering done by the Spanning Tree Protocol that can filter packets based on topology, making sure that signal loops don't occur.
- Filtering done for VLAN integrity. Packets from a member of a VLAN (VLAN 2, for example) destined for a device on another VLAN (VLAN 3) will be filtered.

Some filtering requires the manual entry of information into a filtering table:

- MAC address filtering – the manual entry of specific MAC addresses to be filtered from the network. Packets sent from one manually entered MAC address can be filtered from the network. The entry may be specified as source, destination, or both.

Spanning Tree Protocol

The IEEE 802.1D Spanning Tree Protocol allows for the blocking of links between switches that form loops within the network. When multiple links between switches are detected, a primary link is established. Duplicated links are blocked from use and become standby links. The protocol allows for the duplicate links to be used in the event of a failure of the primary link. Once the Spanning Tree Protocol is configured and enabled, primary links are established and duplicated

links are blocked automatically. The reactivation of the blocked links (at the time of a primary link failure) is also accomplished automatically – without operator intervention.

This automatic network reconfiguration provides maximum uptime to network users. However, the concepts of the Spanning Tree Algorithm and protocol are a complicated and complex subject and must be fully researched and understood. It is possible to cause serious degradation of the performance of the network if the Spanning Tree is incorrectly configured. Please read the following before making any changes from the default values.

The DES-3226 STP allows two levels of spanning trees to be configured. The first level constructs a spanning tree on the links between switches. This is referred to as the **Switch** or **Global** level. The second level is on a port basis. Ports are configured as individual members of a spanning tree and the algorithm and protocol are applied to the specified ports. This is referred to as the **Port** or **VLAN** level.

The Switch STP performs the following functions:

- Creates a single spanning tree from any combination of switching or bridging elements.
- Automatically reconfigures the spanning tree to compensate for the failure, addition, or removal of any element in the tree.
- Reconfigures the spanning tree without operator intervention.

STP Operation Levels

The Switch allows for two levels of operation: the switch level and the port level. The switch level forms a spanning tree consisting of links between one or more switches. The port level constructs a spanning tree consisting of groups of one or more ports. The STP operates in much the same way for both levels.

On the switch level, STP calculates the Bridge Identifier for each switch and then sets the Root Bridge and the Designated Bridges.

On the port level, STP sets the Root Port and the Designated Ports.

The following are the user-configurable STP parameters for the switch level:

Parameter	Description	Default Value
Bridge Identifier (Not user-configurable except by setting priority below)	A combination of the User-set priority and the switch's MAC address. The Bridge Identifier consists of two parts: a 16-bit priority and a 48-bit Ethernet MAC address	32768 + MAC
Priority	A relative priority for each switch – lower numbers give a higher priority and a greater chance of a given switch being elected as the root bridge	32768
Hello Time	The length of time between broadcasts of the hello message by the switch	2 seconds
Maximum Age Timer	Measures the age of a received BPDU for a port and ensures that the BPDU is discarded when its age exceeds the value of the maximum	20 seconds

	age timer.	
Forward Delay Timer	The amount time spent by a port in the learning and listening states waiting for a BPDU that may return the port to the blocking state.	15 seconds

Table 5-1. STP Parameters – Switch Level

The following are the user-configurable STP parameters for the port or port group level:

Variable	Description	Default Value
Port Priority	A relative priority for each port – lower numbers give a higher priority and a greater chance of a given port being elected as the root port	32768
Port Cost	A value used by STP to evaluate paths – STP calculates path costs and selects the path with the minimum cost as the active path.	100 – 100Mbps Fast Ethernet ports

Table 5-2. STP Parameters – Port Group Level

Bridge Protocol Data Units

For STP to arrive at a stable network topology, the following information is used:

- The unique switch identifier
- The path cost to the root associated with each switch port
- The port identifier

STP communicates between switches on the network using Bridge Protocol Data Units (BPDUs). Each BPDU contains the following information:

- The unique identifier of the switch that the transmitting switch currently believes is the root switch
- The path cost to the root from the transmitting port
- The port identifier of the transmitting port

The Switch sends BPDUs to communicate and construct the spanning-tree topology. All switches connected to the LAN on which the packet is transmitted will receive the BPDU. BPDUs are not directly forwarded by the switch, but the receiving switch uses the information in the frame to calculate a BPDU, and, if the topology changes, initiates a BPDU transmission.

The communication between switches via BPDUs results in the following:

- One switch is elected as the root switch
- The shortest distance to the root switch is calculated for each switch

- A designated switch is selected. This is the switch closest to the root switch through which packets will be forwarded to the root.
- A port for each switch is selected. This is the port providing the best path from the switch to the root switch.
- Ports included in the STP are selected.

Creating a Stable STP Topology

If all switches have STP enabled with default settings, the switch with the lowest MAC address in the network will become the root switch. By increasing the priority (lowering the priority number) of the best switch, STP can be forced to select the best switch as the root switch.

When STP is enabled using the default parameters, the path between source and destination stations in a switched network might not be ideal. For instance, connecting higher-speed links to a port that has a higher number than the current root port can cause a root-port change. The goal is to make the fastest link the root port.

STP Port States

The BPDUs take some time to pass through a network. This propagation delay can result in topology changes where a port that transitioned directly from a Blocking state to a Forwarding state could create temporary data loops. Ports must wait for new network topology information to propagate throughout the network before starting to forward packets. They must also wait for the packet lifetime to expire for BPDU packets that were forwarded based on the old topology. The forward delay timer is used to allow the network topology to stabilize after a topology change. In addition, STP specifies a series of states a port must transition through to further ensure that a stable network topology is created after a topology change.

Each port on a switch using STP exists is in one of the following five states:

- Blocking – the port is blocked from forwarding or receiving packets
- Listening – the port is waiting to receive BPDU packets that may tell the port to go back to the blocking state
- Learning – the port is adding addresses to its forwarding database, but not yet forwarding packets
- Forwarding – the port is forwarding packets
- Disabled – the port only responds to network management messages and must return to the blocking state first

A port transitions from one state to another as follows:

- From initialization (switch boot) to blocking
- From blocking to listening or to disabled
- From listening to learning or to disabled
- From learning to forwarding or to disabled
- From forwarding to disabled
- From disabled to blocking

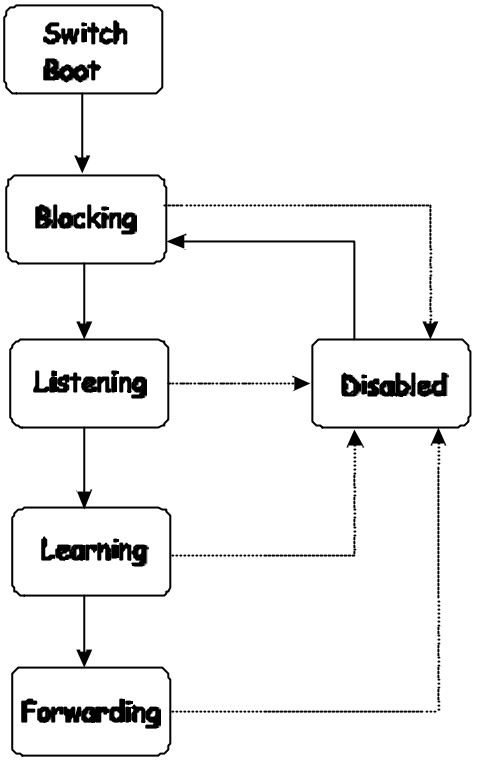


Figure 5-3. STP Port State Transitions

When you enable STP, every port on every switch in the network goes through the blocking state and then transitions through the states of listening and learning at power up. If properly configured, each port stabilizes to the forwarding or blocking state.

No packets (except BPDUs) are forwarded from, or received by, STP enabled ports until the forwarding state is enabled for that port.

Default Spanning-Tree Configuration

Feature	Default Value
Enable state	STP enabled for all ports
Port priority	128
Port cost	100
Bridge Priority	32,768

Table 5-3. Default STP Parameters

User-Changeable STP Parameters

The factory default setting should cover the majority of installations. However, it is advisable to keep the default settings as set at the factory; unless, it is absolutely necessary. The user changeable parameters in the Switch are as follows:

- **Priority** – A Priority for the switch can be set from 0 to 65535. 0 is equal to the highest Priority.
- **Hello Time** – The Hello Time can be from 1 to 10 seconds. This is the interval between two transmissions of BPDU packets sent by the Root Bridge to tell all other Switches that it is indeed the Root Bridge. If you set a

Hello Time for your Switch, and it is not the Root Bridge, the set Hello Time will be used if and when your Switch becomes the Root Bridge.

Note: *The Hello Time cannot be longer than the Max. Age. Otherwise, a configuration error will occur.*

- **Max. Age** – The Max. Age can be from 6 to 40 seconds. At the end of the Max. Age, if a BPDU has still not been received from the Root Bridge, your Switch will start sending its own BPDU to all other Switches for permission to become the Root Bridge. If it turns out that your Switch has the lowest Bridge Identifier, it will become the Root Bridge.
- **Forward Delay Timer** – The Forward Delay can be from 4 to 30 seconds. This is the time any port on the Switch spends in the listening state while moving from the blocking state to the forwarding state.

  Note: *Observe the following formulas when setting the above parameters:*

  Max. Age 2 x (Forward Delay - 1 second)
  Max. Age 2 x (Hello Time + 1 second)

- **Port Priority** – A Port Priority can be from 0 to 255. The lower the number, the greater the probability the port will be chosen as the Root Port.
- **Port Cost** – A Port Cost can be set from 1 to 65535. The lower the number, the greater the probability the port will be chosen to forward packets.

Illustration of STP

A simple illustration of three Bridges (or three switches) connected in a loop is depicted in Figure 5-3. In this example, you can anticipate some major network problems if the STP assistance is not applied. If Bridge A broadcasts a packet to Bridge B, Bridge B will broadcast it to Bridge C, and Bridge C will broadcast it to back to Bridge A, and so on. The broadcast packet will be passed indefinitely in a loop, potentially causing a network failure.

STP can be applied as shown in Figure 5-4. In this example, STP breaks the loop by blocking the connection between Bridge B and C. The decision to block a particular connection is based on the STP calculation of the most current Bridge and Port settings. Now, if Bridge A broadcasts a packet to Bridge C, then Bridge C will drop the packet at port 2 and the broadcast will end there.

Setting-up STP using values other than the defaults can be complex. Therefore, you are advised to keep the default factory settings and STP will automatically assign root bridges/ports and block loop connections. Influencing STP to choose a particular switch as the root bridge using the **Priority** setting, or influencing STP to choose a particular port to block using the **Port Priority** and **Port Cost** settings is, however, relatively straight forward.

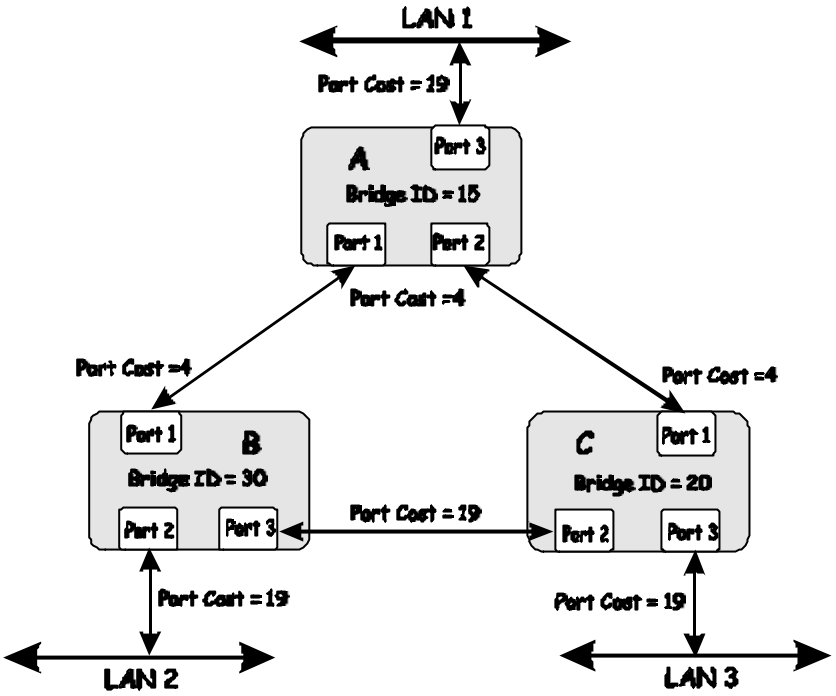


Figure 5-4. Before Applying the STA Rules

In this example, only the default STP values are used.

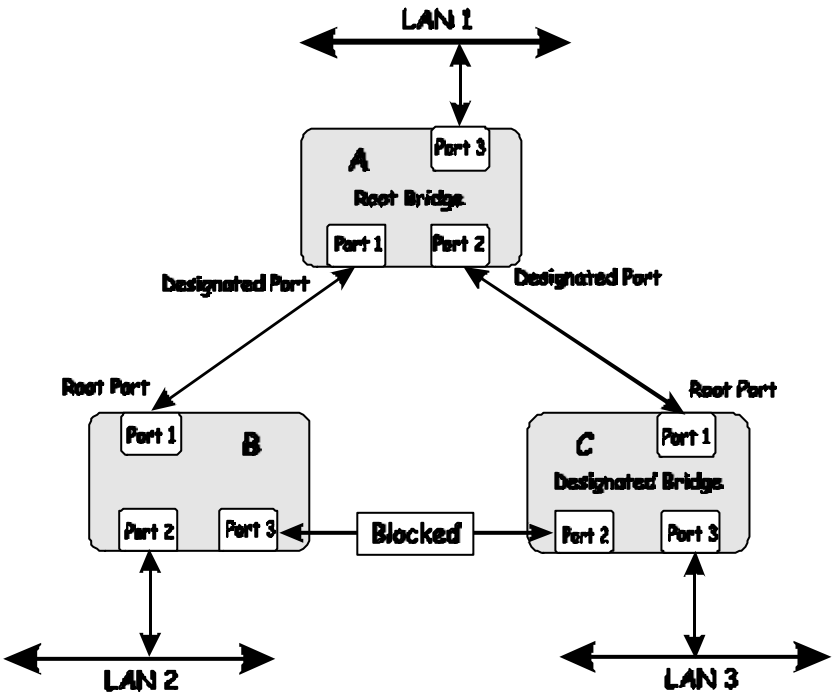


Figure 5-5. After Applying the STA Rules

The switch with the lowest Bridge ID (switch C) was elected the root bridge, and the ports were selected to give a high port cost between switches B and C.

Note also that the example network topology is intended to provide redundancy to protect the network against a link or port failure – not a switch failure or removal. For example, a failure of switch A would isolate LAN 1 from connecting to LAN 2 or LAN 3.

VLANs

A Virtual Local Area Network (VLAN) is a network topology configured according to a logical scheme rather than the physical layout. VLANs can be used to combine any collection of LAN segments into an autonomous user group that appears as a single LAN. VLANs also logically segment the network into different broadcast domains so that packets are forwarded only between ports within the VLAN. Typically, a VLAN corresponds to a particular subnet, although not necessarily.

VLANs can enhance performance by conserving bandwidth, and improve security by limiting traffic to specific domains.

A VLAN is a collection of end nodes grouped by logic instead of physical location. End nodes that frequently communicate with each other are assigned to the same VLAN, regardless of where they are physically on the network. Logically, a VLAN can be equated to a broadcast domain, because broadcast packets are forwarded to only members of the VLAN on which the broadcast was initiated.

Notes About VLANs on the DES-3226

1. *No matter what basis is used to uniquely identify end nodes and assign these nodes VLAN membership, packets* ***cannot*** *cross VLANs without a network device performing a routing function between the VLANs.*
2. *The DES-3226 supports only IEEE 802.1Q VLANs. The port untagging function can be used to remove the 802.1Q tag from packet headers to maintain compatibility with devices that are tag-unaware.*
3. *The Switch's default is to assign all ports to a single 802.1Q VLAN named* DEFAULT_VLAN*.*
4. *The* DEFAULT_VLAN *has a VID = 1.*
5. *The DES-3226 supports Asymmetric VLANs. The member ports of VLANs can be overlapped.*

IEEE 802.1Q VLANs

Some relevant terms:

- **Tagging** – The act of putting 802.1Q VLAN information into the header of a packet.
- **Untagging** – The act of stripping 802.1Q VLAN information out of the packet header.
- **Ingress port** – A port on a switch where packets are flowing into the switch and VLAN decisions must be made.
- **Egress port** – A port on a switch where packets are flowing out of the switch, either to another switch or to an end station, and tagging decisions must be made.

IEEE 802.1Q (tagged) VLANs are implemented on the DES-3226. 802.1Q VLANs require tagging, which enables them to span the entire network (assuming all switches on the network are IEEE 802.1Q-compliant).

VLANs allow a network to be segmented in order to reduce the size of broadcast domains. All packets entering a VLAN will only be forwarded to the stations (over IEEE 802.1Q enabled switches) that are members of that VLAN, and this includes broadcast, multicast and unicast packets from unknown sources.

VLANs can also provide a level of security to your network. IEEE 802.1Q VLANs will only deliver packets between stations that are members of the VLAN.

Any port can be configured as either *tagging* or *untagging*. The *untagging* feature of IEEE 802.1Q VLANs allow VLANs to work with legacy switches that don't recognize VLAN tags in packet headers. The *tagging* feature allows VLANs to span multiple 802.1Q-compliant switches through a single physical connection and allows Spanning Tree to be enabled on all ports and work normally.

The IEEE 802.1Q standard restricts the forwarding of untagged packets to the VLAN the receiving port is a member of.

The main characteristics of IEEE 802.1Q are as follows:

- Assigns packets to VLANs by filtering.
- Assumes the presence of a single global spanning tree.
- Uses an explicit tagging scheme with one-level tagging.

802.1Q VLAN Packet Forwarding

Packet forwarding decisions are made based upon the following three types of rules:

- Ingress rules – rules relevant to the classification of received frames belonging to a VLAN.
- Forwarding rules between ports – decides filter or forward the packet
- Egress rules – determines if the packet must be sent tagged or untagged.

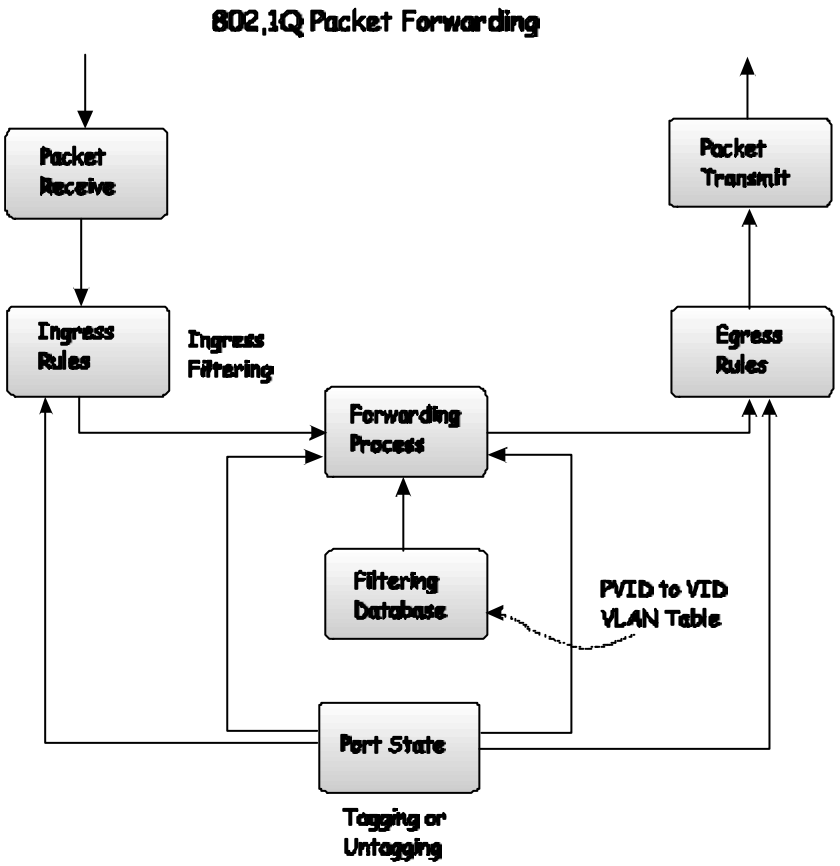


Figure 5-6. IEEE 802.1Q Packet Forwarding

802.1Q VLAN Tags

The figure below shows the 802.1Q VLAN tag. There are four additional octets inserted after the source MAC address. Their presence is indicated by a value of 0x8100 in the EtherType field. When a packet's EtherType field is equal to 0x8100, the packet carries the IEEE 802.1Q/802.1p tag. The tag is contained in the following two octets and consists of 3 bits or user priority, 1 bit of Canonical Format Identifier (CFI – used for encapsulating Token Ring packets so they can be carried across Ethernet backbones) and 12 bits of VLAN ID (VID). The 3 bits of user priority are used by 802.1p. The VID is the VLAN identifier and is used by the 802.1Q standard. Because the VID is 12 bits long, 4094 unique VLANs can be identified.

The tag is inserted into the packet header making the entire packet longer by 4 octets. All of the information contained in the packet originally is retained.

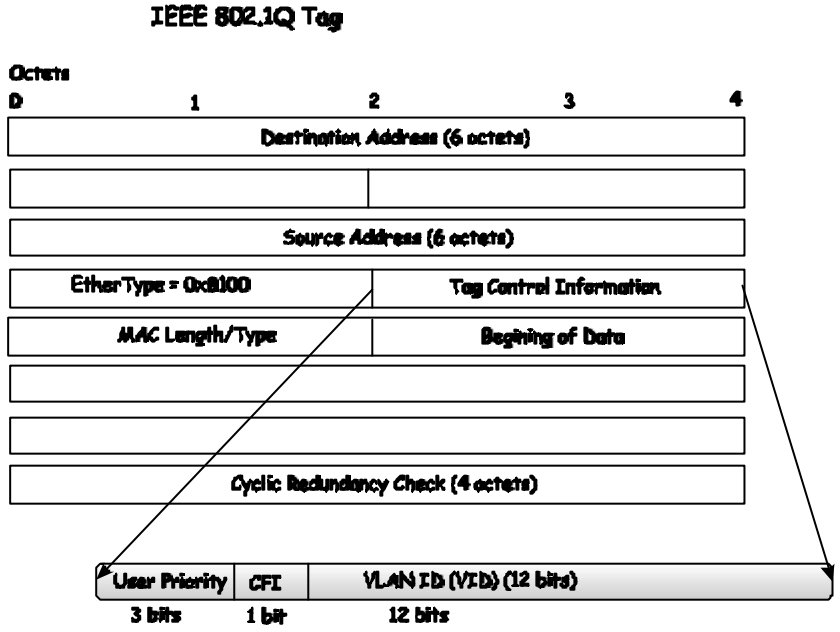


Figure 5-7. IEEE 802.1Q Tag

The EtherType and VLAN ID are inserted after the MAC source address, but before the original EtherType/Length or Logical Link Control. Because the packet is now a bit longer than it was originally, the Cyclic Redundancy Check (CRC) must be recalculated.

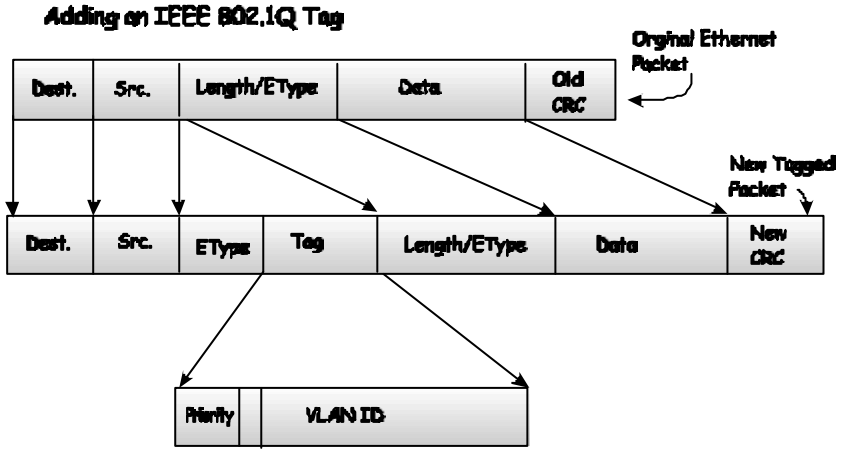


Figure 5-8. Adding an IEEE 802.1Q Tag

Port VLAN ID

Packets that are tagged (are carrying the 802.1Q VID information) can be transmitted from one 802.1Q compliant network device to another with the VLAN information intact. This allows 802.1Q VLANs to span network devices (and indeed, the entire network – if all network devices are 802.1Q compliant).

Unfortunately, not all network devices are 802.1Q compliant. These devices are referred to as *tag-unaware*. 802.1Q devices are referred to as *tag-aware*.

Prior to the adoption 802.1Q VLANs, port-based and MAC-based VLANs were in common use. These VLANs relied upon a Port VLAN ID (PVID) to forward packets. A packet received on a given port would be assigned that port's PVID and then be forwarded to the port that corresponded to the packet's destination address (found in the switch's forwarding table). If the PVID of the port that received the packet is different from the PVID of the port that is to transmit the packet, the switch will drop the packet.

Within the switch, different PVIDs mean different VLANs (remember that two VLANs cannot communicate without an external router). So, VLAN identification based upon the PVIDs cannot create VLANs that extend outside a given switch (or switch stack).

Every physical port on a switch has a PVID. 802.1Q ports are also assigned a PVID, for use within the switch. If no VLANs are defined on the switch, all ports are then assigned to a default VLAN with a PVID equal to 1. Untagged packets are assigned the PVID of the port on which they were received. Forwarding decisions are based upon this PVID, in so far as VLANs are concerned. Tagged packets are forwarded according to the VID contained within the tag. Tagged packets are also assigned a PVID, but the PVID is not used to make packet forwarding decisions, the VID is.

Tag-aware switches must keep a table to relate PVIDs within the switch to VIDs on the network. The switch will compare the VID of a packet to be transmitted to the VID of the port that is to transmit the packet. If the two VIDs are different, the switch will drop the packet. Because of the existence of the PVID for untagged packets and the VID for tagged packets, tag-aware and tag-unaware network devices can coexist on the same network.

A switch port can have only one PVID, but can have as many VIDs as the switch has memory in its VLAN table to store them.

Because some devices on a network may be tag-unaware, a decision must be made at each port on a tag-aware device before packets are transmitted – should the packet to be transmitted have a tag or not? If the transmitting port is connected to a tag-unaware device, the packet should be untagged. If the transmitting port is connected to a tag-aware device, the packet should be tagged.

Tagging and Untagging

Every port on an 802.1Q compliant switch can be configured as *tagging* or *untagging*.

Ports with tagging enabled will put the VID number, priority and other VLAN information into the header of all packets that flow into and out of it. If a packet has previously been tagged, the port will not alter the packet, thus keeping the VLAN information intact. The VLAN information in the tag can then be used by other 802.1Q compliant devices on the network to make packet forwarding decisions.

Ports with untagging enabled will strip the 802.1Q tag from all packets that flow into and out of those ports. If the packet doesn't have an 802.1Q VLAN tag, the port will not alter the packet. Thus, all packets received by and forwarded by an untagging port will have no 802.1Q VLAN information (Remember that the PVID is only used internally within the switch). Untagging is used to send packets from an 802.1Q-compliant network device to a non-compliant network device.

Ingress Filtering

A port on a switch where packets are flowing into the switch and VLAN decisions must be made is referred to as an *ingress port*. If ingress filtering is enabled for a port, the switch will examine the VLAN information in the packet header (if present) and decide whether or not to forward the packet.

If the packet is tagged with VLAN information, the ingress port will first determine if the ingress port itself is a member of the tagged VLAN. If it is not, the packet will be dropped. If the ingress port is a member of the 802.1Q VLAN, the switch then determines if the destination port is a member of the 802.1Q VLAN. If it is not, the packet is dropped. If the destination port is a member of the 802.1Q VLAN, the packet is forwarded and the destination port transmits it to its attached network segment.

If the packet is not tagged with VLAN information, the ingress port will tag the packet with its own PVID as a VID (if the port is a tagging port). The switch then determines if the destination port is a member of the same VLAN (has the same VID) as the ingress port. If it does not, the packet is dropped. If it has the same VID, the packet is forwarded and the destination port transmits it on its attached network segment.

This process is referred to as *ingress filtering* and is used to conserve bandwidth within the switch by dropping packets that are not on the same VLAN as the ingress port at the point of reception. This eliminates the subsequent processing of packets that will just be dropped by the destination port.

VLANs

The Switch initially configures one VLAN, VID = 1, called the DEFAULT_VLAN. The factory default setting assigns all ports on the Switch to the DEFAULT_VLAN. As new VLANs are configured, their respective member ports are removed from the DEFAULT_VLAN.

Packets cannot cross VLANs. If a member of one VLAN wants to connect to another VLAN, the link must be through an external router.

> ***Note:*** *If no VLANs are configured on the switch, then all packets will be forwarded to any destination port. Packets with unknown source addresses will be flooded to all ports. Broadcast and multicast packets will also be flooded to all ports.*

> ***Note****: Each IP interface on the Switch corresponds to a VLAN. The VLAN must be configured before the IP interface can be setup. The IP interface must have the same name (and the same VID number) as its corresponding VLAN.*

The Switch allows ranges of IP addresses to be assigned to VLANs. Each VLAN must be configured prior to setting up the corresponding IP interface. An IP addressing scheme must then be established, and implemented when the IP interfaces are set up on the Switch.

An example is presented below:

VLAN Name	VID	Switch Ports
System (default)	1	5, 6, 7, 8, 21, 22, 23, 24
Engineering	2	9, 10, 11, 12
Marketing	3	13, 14, 15, 16
Finance	4	17, 18, 19, 20
Sales	5	1, 2, 3, 4

Table 5-4. VLAN Example – Assigned Ports

In this case, 5 IP interfaces (or 5 subnets) are required, so a CIDR notation of 10.32.0.0/3 (or a 3-bit) addressing scheme will work. This addressing scheme will give a subnet mask of 11111111.11100000.00000000.00000000 (binary) or 255.224.0.0 (decimal).

Using a 10.xxx.xxx.xxx IP address notation would give 5 network addresses:

VLAN Name	VID	Network Address
System (default)	1	10.32.0.0
Engineering	2	10.64.0.0
Marketing	3	10.96.0.0
Finance	4	10.128.0.0
Sales	5	10.160.0.0

Table 5-5. VLAN Example – Assigned Network Addresses

Note: *IP interfaces consist of two parts – a subnet mask and a network address.*

Note*: Each IP interface listed above will give a maximum of 2,080,800 unique IP addresses per interface (assuming the 10.xxx.xxx.xxx notation).*

DHCP Servers

The Dynamic Host Configuration Protocol (DHCP) can reduce the administrative burden of assigning and maintaining IP address information. DHCP provides reliable and simple TCP/IP network configuration, ensures that address conflicts do not occur, and helps to conserve the use of IP addresses through the centralized management of address allocation.

Dynamic address allocation enables a client to be assigned an IP address from a pool of free addresses. Each address is assigned with a lease and a lease expiration period. The client must renew the lease to continue using the assigned address. Dynamically assigned addresses can be returned to the free address pool if the computer is not being used, if it is moved to another subnet, of if its lease expires. Usually, network policy ensures that the same IP address is assigned to a client each time and that addresses returned to the free address pool are reassigned.

When the address lease expires, the DHCP client enters the renewing state. The client sends a request message to the DHCP server that provided the address. The DHCP server sends an acknowledgement that contains the new lease and configuration parameters. The client then updates its configuration values and returns to the bound state.

When the DHCP client is in the renewing state, it must release its address immediately in the rare event that the DHCP server sends a negative acknowledgment. The DHCP server sends this message to inform a client that it has incorrect configuration information, forcing it to release its current address and acquire new information.

If the DHCP client cannot successfully renew its lease, the client enters a rebinding state. The client then sends a request message to all DHCP servers in its range, attempting to renew its lease. Any DHCP server that can extend the lease sends and acknowledgement containing the extended lease and updated configuration information. IF the lease expires or if a DHCP server responds with a negative acknowledgement, the client must release its current configuration, and then return to the initializing state.

If the DHCP client uses more than one network adapter to connect to multiple networks, this protocol is followed for each adapter that the user wants to configure for TCP/IP. Multi-homed systems are selectively configured for any combination of the system's interfaces.

When a DHCP-enabled computer is restarted, it sends a message to the DHCP server with its current configuration information. The DHCP server either confirms this configuration or sends a negative reply so that the client must begin the initializing state again. System startup might, therefore, result in a new IP address for a client computer, but neither the user nor the network administrator has to take any action in the configuration process.

Before loading TCP/IP with an address acquired from the DHCP server, DHCP clients check for an IP address conflict by sending an Address Resolution Protocol (ARP) request containing the address. If a conflict is found, TCP/IP does not start, and the user receives an error message. The conflicting address should be removed for the list of active leases or it should be excluded until the conflict is identified and resolved.

6

CONFIGURING THE SWITCH USING THE CONSOLE INTERFACE

Your 24-port NWay Standalone Fast Ethernet Switch with one optional slide-in module supports a console management interface that allows you to set up and control your Switch, either with an ordinary terminal (or terminal emulator), or over the network using the TCP/IP Telnet protocol. You can use this facility to perform many basic network management functions. In addition, the console program will allow you to configure the Switch for management using an SNMP-based network management system. This chapter describes how to use the console interface to access the Switch, change its settings, and monitor its operation.

Notes are added where clarification is necessary.

Before You Start

The DES-3226 supports a wide array of functions and gives great flexibility and increased network performance by eliminating the routing bottleneck between the WAN or Internet and the Intranet. Its function in a network can be thought of as a new generation of router that performs routing functions in hardware, rather than software.

This flexibility and rich feature set requires a bit of thought to arrive at a deployment strategy that will maximize the potential of the Switch.

Connecting to the Switch

You can use the console interface by connecting the Switch to a VT100-compatible terminal or a computer running an ordinary terminal emulator program (e.g., the terminal program included with the Windows operating system) using an RS-232C serial cable. Your terminal parameters will need to be set to:

- VT-100/ANSI compatible
- 9,600 baud
- 8 data bits
- No parity
- One stop bit
- No flow control

You can also access the same functions over a Telnet interface. Once you have set an IP address for your Switch, you can use a Telnet program (in VT-100 compatible terminal mode) to access and control the Switch. All of the screens are identical, whether accessed from the console port or from a Telnet interface.

Console Usage Conventions

The console interface makes use of the following conventions:

1. Items in **<***angle brackets***>** can be toggled between several choices using the space bar.
2. Items in **[***square brackets***]** can be changed by typing in a new value. You can use the backspace and delete keys to erase characters behind and in front of the cursor.
3. The up and down arrow keys, the left and right arrow keys, the tab key and the backspace key, can be used to move between selected items.
4. Items in **UPPERCASE** are commands. Moving the selection to a command and pressing Enter will execute that command, e.g. APPLY, etc.

Please note that the command APPLY only applies for the current session. Use **Save Changes** from the main menu for permanent changes. **Save Changes** enters the current switch configuration into non-volatile RAM, and then reboots the Switch.

First Time Connecting to The Switch

The Switch supports user-based security that can allow you to prevent unauthorized users from accessing the Switch or changing its settings. This section tells how to log onto the Switch.

Note: *The passwords used to access the Switch are case-sensitive; therefore, "S" is not the same as "s."*

When you first connect to the Switch, you will be presented with the first login screen (shown below).

Note: *Press Ctrl+R to refresh the screen. This command can be used at any time to force the console program in the Switch to refresh the console screen.*

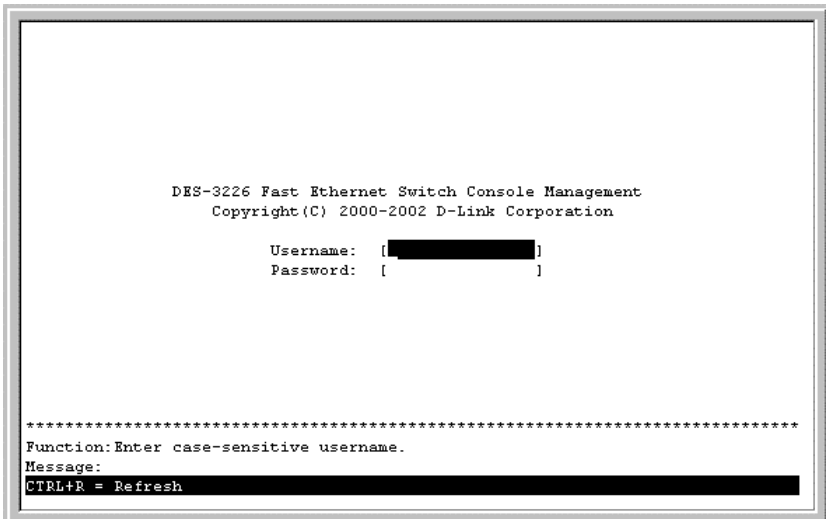


Figure 6-1. Initial screen, first time connecting to the Switch

Note*: There is no initial username or password. Leave the* **Username** *and* **Password** *fields blank.*

Press **Enter** in both the Username and Password fields. You will be given access to the main menu shown below:

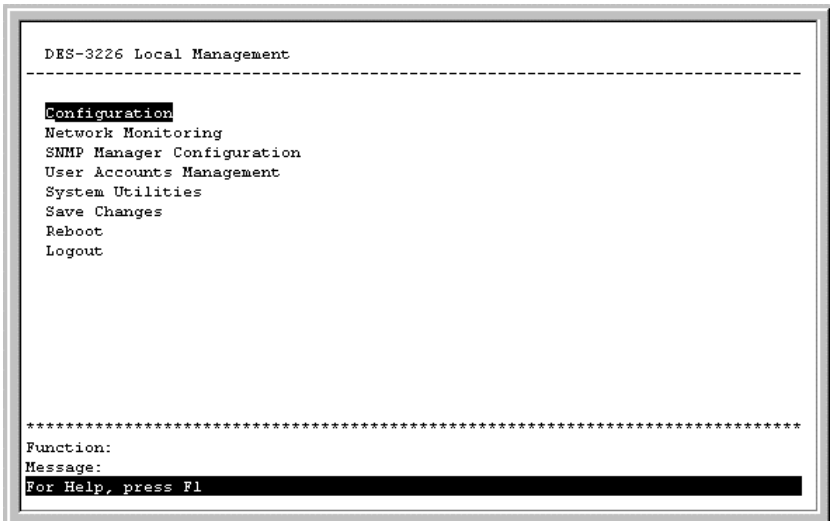


Figure 6-2. Main menu

***Note**: The first user automatically gets Root privileges (See Table 6-1). It is recommended to create at least one Root-level user for the Switch.*

User Accounts Management

To create a new user account, highlight **User Accounts Management** from the main menu and press **Enter**:

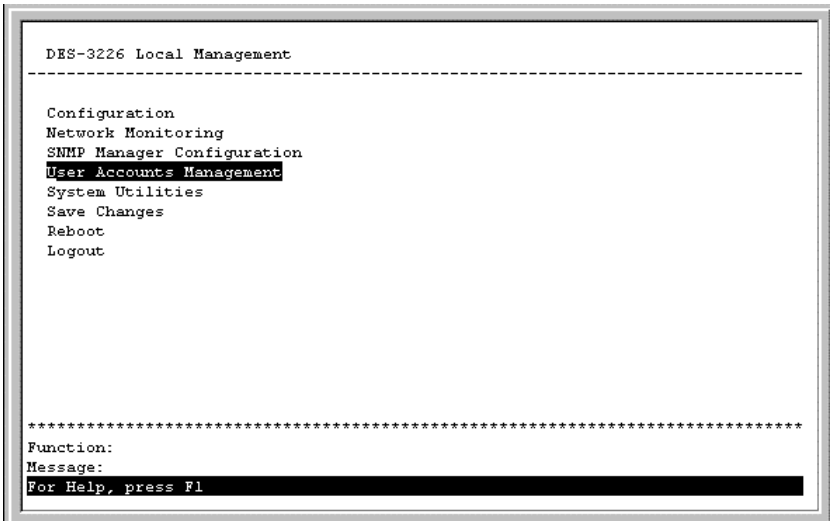


Figure 6-3. Main menu

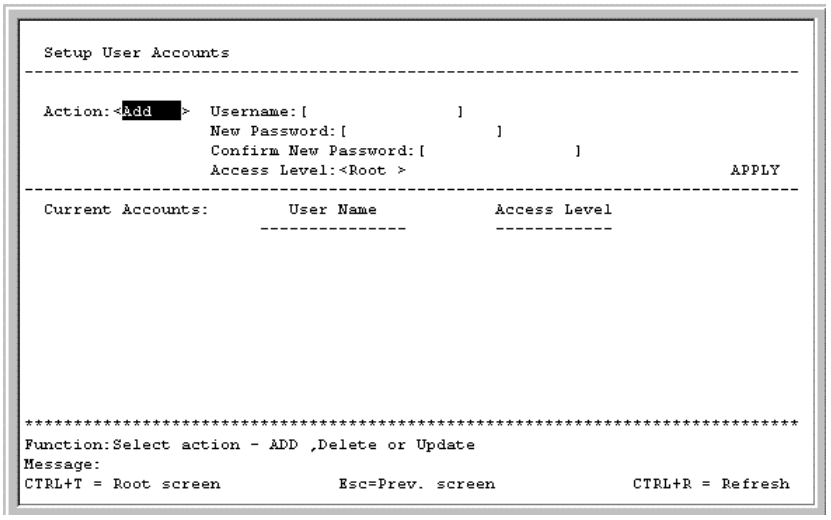

Setup User Accounts
Action:<Add > Username:[ ]
New Password:[ ]
Confirm New Password:[ ]
Access Level:<Root > APPLY
Current Accounts: User Name Access Level
Function:Select action - ADD ,Delete or Update
Message:
CTRL+T = Root screen Esc=Prev. screen CTRL+R = Refresh

Figure 6-4. Setup User Accounts screen

From the main menu, highlight **User Accounts Management** and press **Enter**, then the **Setup User Accounts** screen appears.

1. Toggle the **Action:<** **>** field to <*Add*> using the space bar. This will allow the addition of a new user. The other options are <*Delete*> - this allows the deletion of a user entry, and <*Update*> - this allows for changes to be made to an existing user entry.

2. Enter the new user name, assign an initial password, and then confirm the new password. Determine whether the new user should have <*Root*>, <*User+*>, or <*User*> privileges. The space bar toggles between the three options.

3. Highlight APPLY and press **Enter** to make the user addition effective.

4. Press **Esc**. to return to the previous screen or Ctrl+T to go to the root screen.

5. A listing of all user accounts and access levels is shown below the user setup menu. This list is updated when APPLY is executed.

6. Please remember that APPLY makes changes to the switch configuration for the ***current session only.*** All changes (including User additions or updates) must be entered into non-volatile ram using the **Save Changes** command on the main menu - if you want these changes to be permanent.

Root, User+ and Normal User Privileges

There are three levels of user privileges: *Root* and *User+*, and *User*. Some menu selections available to users with *Root* privileges may not be available to those with *User+* and *User* privileges.

The following table summarizes the *Root, User+* and *User* privileges:

Switch Configuration	***Privilege***		
Management	***Root***	***User+***	***User***
Configuration	Yes	Read Only	Read Only
Network Monitoring	Yes	Read Only	Read Only
Community Strings and Trap Stations	Yes	Read Only	Read Only
Update Firmware and Configuration Files	Yes	No	No
System Utilities	Yes	Ping Only	Ping Only
Factory Reset	Yes	No	No

Reboot Switch	Yes	Yes	No
User Accounts Management			
Add/Update/Delete User Accounts	Yes	No	No
View User Accounts	Yes	No	No

Table 6-1. Root, User+, and User Privileges

After establishing a User Account with **Root**-level privileges, press **Esc**. Then highlight **Save Changes** and press **Enter** (see below). The Switch will save any changes to its non-volatile ram and reboot. You can logon again and are now ready to continue configuring the Switch.

Save Changes

The DES-3226 has two levels of memory; normal RAM and non-volatile or NV-RAM. Configuration changes are made effective by highlighting APPLY and pressing **Enter**. When this is done, the settings will be immediately applied to the switching software in RAM, and will immediately take effect.

Some settings, though, require you to restart the Switch before they will take effect. Restarting the Switch erases all settings in RAM and reloads the stored settings from the NV-RAM. Thus, it is necessary to save all setting changes to NV-RAM before rebooting the Switch.

To retain any configuration changes permanently, highlight **Save Changes** from the main menu.

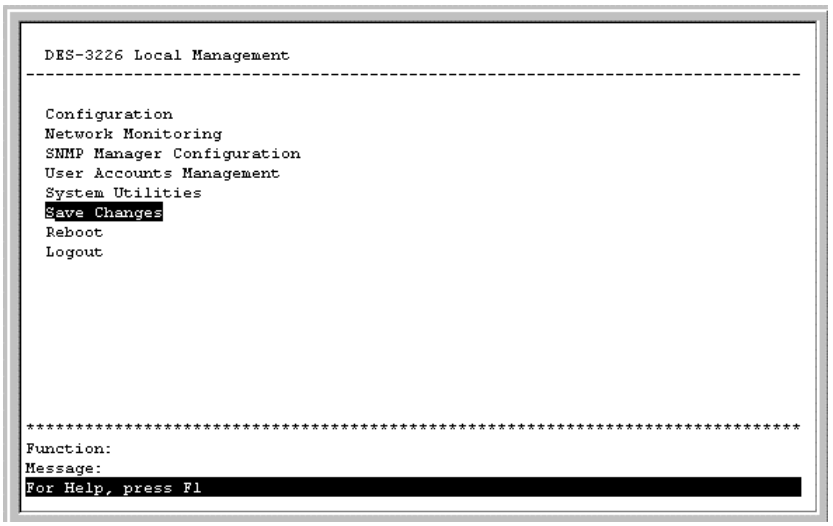


Figure 6-5. Main menu

The following screen will appear to verify that your new settings have been saved to NV-RAM:

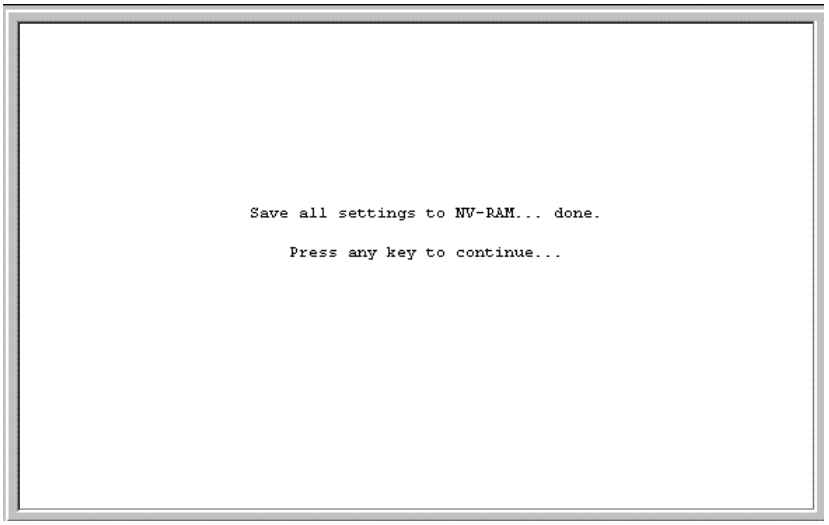


Figure 6-6. Save changes screen

Once the switch configuration settings have been saved to NV-RAM, they become the default settings for the switch. These settings will be used every time the Switch is rebooted.

Factory Reset

The only way to change the configuration stored in NV-RAM is to save a new configuration using **Save Changes**, or to execute a **Load Factory Default Configuration** from the **System Reboot** menu (under **Reboot** on the main menu). This will clear all settings and restore them to their initial values listed in the appendix. These are the configuration settings entered at the factory and are the same settings present when the Switch was purchased.

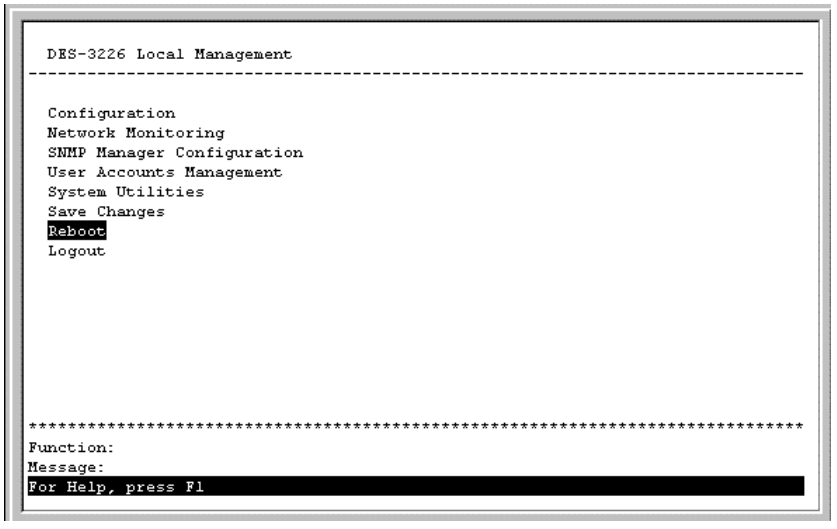


Figure 6-7. Main menu

Highlight **Reboot** from the main menu and press **Enter**.

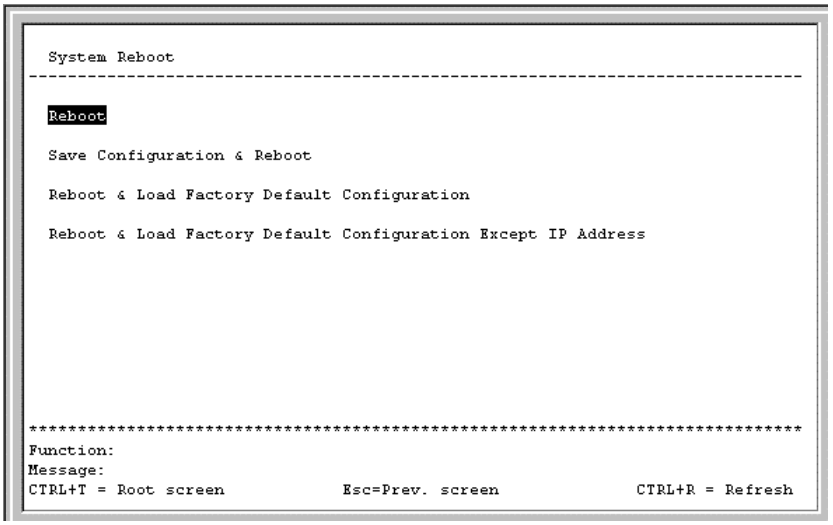


Figure 6-8. System Reboot menu

Highlight the appropriate choice and press **Enter** to reset the Switch's NV-RAM to the factory default settings (or just reboot the Switch). Loading the Factory Default Configuration will erase any User Accounts (and all other configuration settings) you may have entered and return the Switch to the state it was in when it was purchased. The **Load Factory Default Configuration Except IP Address** option is used when the Switch will be managed by the Telnet manager, which requires knowledge of the Switch's IP address to function.

Logging Onto The Switch Console

To log in once you have created a registered user, from the Login screen:

1. Type in your **Username** and press **Enter**.
2. Type in your **Password** and press **Enter**.
3. The main menu screen will be displayed based on your access level or privilege.

Updating or Deleting User Accounts

To update or delete a user password:

Choose **User Accounts Management** from the main menu. The following **Setup User Accounts** screen appears:

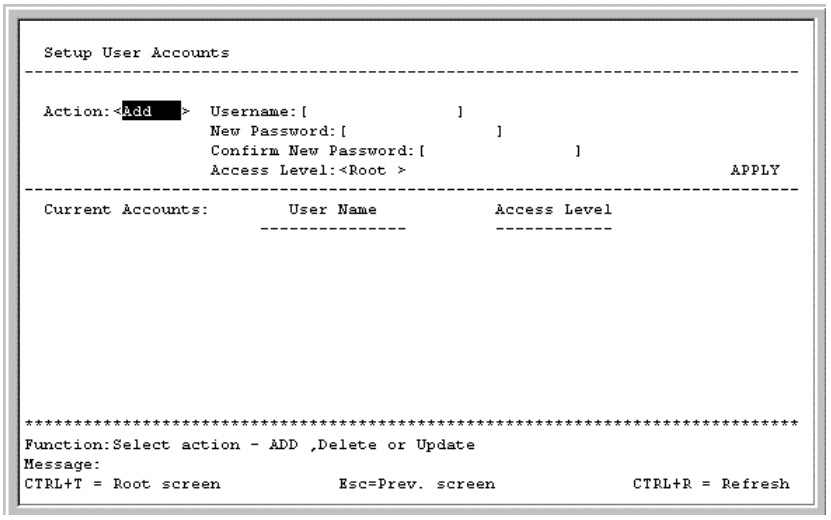

Setup User Accounts
Action:<Add > Username:[ ]
New Password:[ ]
Confirm New Password:[ ]
Access Level:<Root > APPLY
Current Accounts: User Name Access Level
Function:Select action - ADD ,Delete or Update
Message:
CTRL+T = Root screen Esc=Prev. screen CTRL+R = Refresh

Figure 6-9. Setup User Accounts screen

1. Toggle the **Action:<***Add***>** field using the space bar to choose *Add*, *Update*, or *Delete*.
2. Type in the **Username** for the user account you wish to change and enter the **Old Password** for that user account.
3. You can now modify the password or the privilege level for this user account.
4. If the password is to be changed, type in the **New Password** you have chosen, and press **Enter**. Type in the same new password in the following field to verify that you have not mistyped it.
5. If the privilege level is to be changed, toggle the **Access Level:<***Root***>** field until the appropriate level is displayed – **Root, User+** or **User**.
6. Highlight APPLY and press **Enter** to make the change effective.
7. You must enter the configuration changes into the non-volatile ram (NV-RAM) using **Save Changes** from the main menu if you want the configuration to be used after a switch reboot.

Only a user with **Root** privileges can make changes to user accounts.

Viewing Current User Accounts

Access to the console, whether using the console port or via Telnet, is controlled using a user name and password. Up to eight user accounts can be created. The console interface will not let you delete the current logged-in user, to prevent accidentally deleting all of the users with *Root* privilege.

Only users with the ***Root*** privilege can delete users.

To view the current user accounts, highlight **User Accounts Management** from the main menu. The current user accounts can be read from the **Setup User Accounts** screen.

Deleting a User Account

1. Toggle the **Action:<***Add***>** field to **Delete**.
2. Enter the **Username** and **Old Password** for the account you want to delete. You must enter the password for the account to be able to delete it.
3. Highlight APPLY and press **Enter** to make the deletion of the selected user take effect.

4. You must enter the configuration changes into the non-volatile ram (NV-RAM) using **Save Changes** from the main menu if you want the configuration to be used after a switch reboot.

Only users with **Root** privileges can delete user accounts.

Configuration

This section will help prepare the Switch user by describing the **Remote Management Setup**, **Switch Information**, **Configure Advanced Switch Features**, **Configure Ports**, **Bandwidth Configuration**, **Configure Spanning Tree**, **Port Spanning Tree Settings**, **Setup Unicast Filtering Table**, **Setup Static Multicast Filtering Table**, **IEEE 802.1Q VLANs Configuration**, **802.1Q Static VLAN Settings**, **Port VLAN assignment**, **Ingress Filter Settings, Port GVRP Settings, IGMP Snooping Settings, Link Aggregation, Setup Port Mirroring, Setup Threshold of Broadcast/Multicast/DA-Unknown Storm**, **Port Security Settings**, and **Configure Class of Service, Default Priority and Traffic Class** screens, all of which can be found under the **Configuration** menu, along with various submenus.

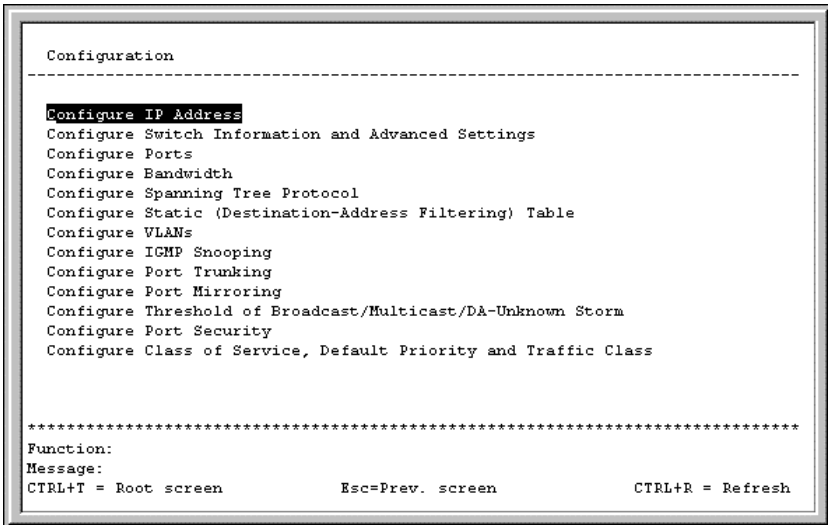


Figure 6-10. Configuration menu

Configure IP Address

Some settings must be entered to allow the Switch to be managed from an SNMP-based Network Management System such as SNMP v1 or to be able to access the Switch using the Telnet protocol.

The **Remote Management Setup** screen lets you specify how the Switch will be assigned an IP address to allow the Switch to be identified on the network.

To setup the Switch for remote management, highlight **Configure IP Address** from the **Configuration** menu. The following screen appears:

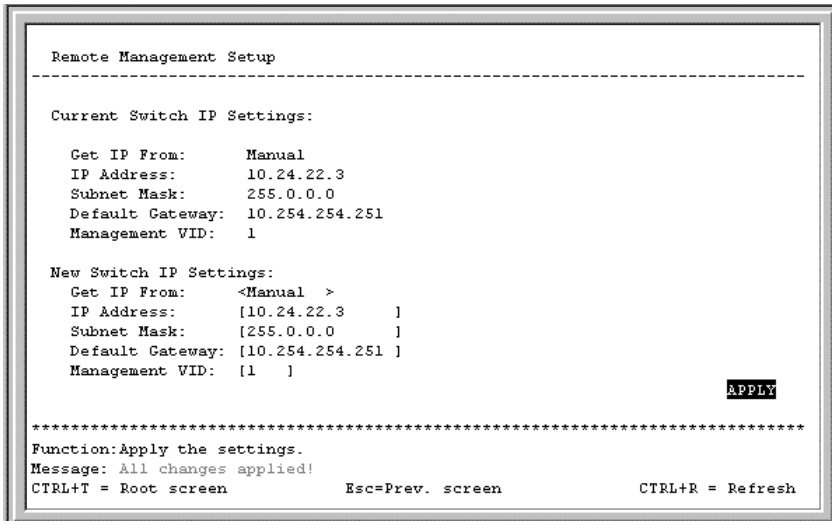


Figure 6-11. Remote Management Setup screen

The Switch needs to have an IP address assigned to it so that an In-Band network management system (e.g. Telnet) client can find it on the network. The **Remote Management Setup** screen allows you to change the settings for the two different management interfaces used on the Switch: the Ethernet interface used for in-band communication, and the SLIP interface used over the console port for out-of-band communication.

The fields listed under the **Current Switch IP Settings** heading are those currently being used by the Switch. Those fields listed under the **New Switch IP Settings** heading are those which will be used after the Switch has been Rebooted.

Toggle the **Get IP From: <** **>** field using the space bar to choose from *Manual*, *BOOTP*, or *DCHP*. This selects how the Switch will be assigned an IP address on the next reboot (or startup).

The **Get IP From: <** **>** options are:

- *BOOTP* – The Switch will send out a BOOTP broadcast request when it is powered up. The BOOTP protocol allows IP addresses, network masks, and default gateways to be assigned by a central BOOTP server. If this option is set, the Switch will first look for a BOOTP server to provide it with this information before using the default or previously entered settings.

- *DCHP* – The Switch will send out a DCHP broadcast request when it is powered up. The DCHP protocol allows IP addresses, network masks, and default gateways to be assigned by a DCHP server. If this option is set, the switch will first look for a DCHP server to provide it with this information before using the default or previously entered settings.

- *Manual* – Allows the entry of an IP address, Subnet Mask, and a Default Gateway for the Switch. These fields should be of the form *xxx.xxx.xxx.xxx*, where each *xxx* is a number (represented in decimal form) between 0 and 255. This address should be a unique address on the network assigned for use by the Network Administrator. The fields which require entries under this option are as follows:

  - *Subnet Mask* – A Bitmask that determines the extent of the subnet that the Switch is on. Should be of the form *xxx.xxx.xxx.xxx*, where each *xxx* is a number (represented in decimal) between 0 and 255. The value should be 255.0.0.0 for a Class A network, 255.255.0.0 for a Class B network, and 255.255.255.0 for a Class C network, but custom subnet masks are allowed.

  - *Default Gateway* – IP address that determines where packets with a destination address outside the current subnet should be sent. This is usually the address of a router or a host acting as an IP gateway. If your network is not part of an intranet, or you do not want the Switch to be accessible outside your local network, you can leave this field unchanged.

- **Management VID:[ ]** – Allows the entry of the VLAN ID (VID) of a VLAN that will have access to the Telnet manager. This will be the VID of the VLAN that a management station is located on.

Configure Switch Information and Advanced Settings

Highlight **Configure Switch Information and Advanced Settings** on the **Configuration** menu and press **Enter**:

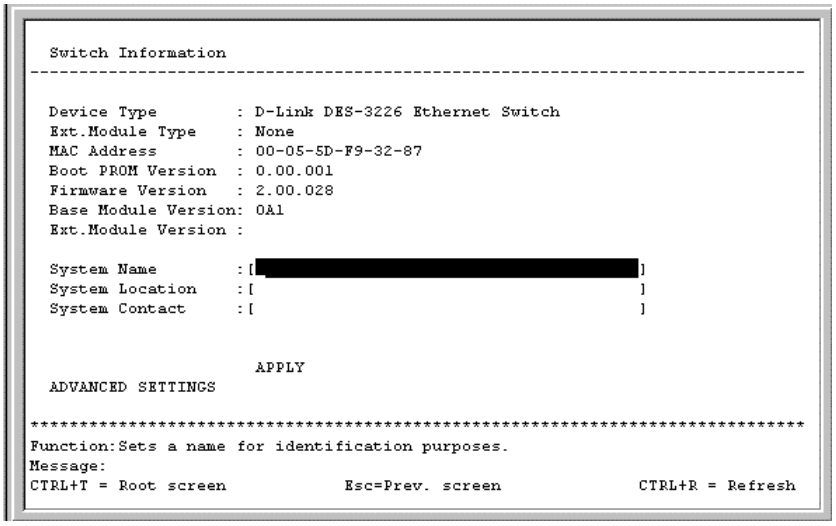


Figure 6-12. Switch Information menu

The **Switch Information** shows the type of switch, which (if any) external modules are installed, and the Switch's **MAC Address** (assigned by the factory and unchangeable). In addition, the **Boot PROM** and **Firmware Version** numbers are shown. This information is helpful to keep track of PROM and Firmware updates and to obtain the Switch's MAC address for entry into another network device's address table – if necessary.

You can also enter the name of the **System**, its location, and the name and telephone number of the System Administrator. It is recommended that the person responsible for the maintenance of the network system that this Switch is installed on be listed here.

Configure Advanced Switch Features

Select ADVANCED SETTINGS at the bottom of the **Switch Information** menu and press **Enter** to access the following **Configure Advanced Switch Features** screen:

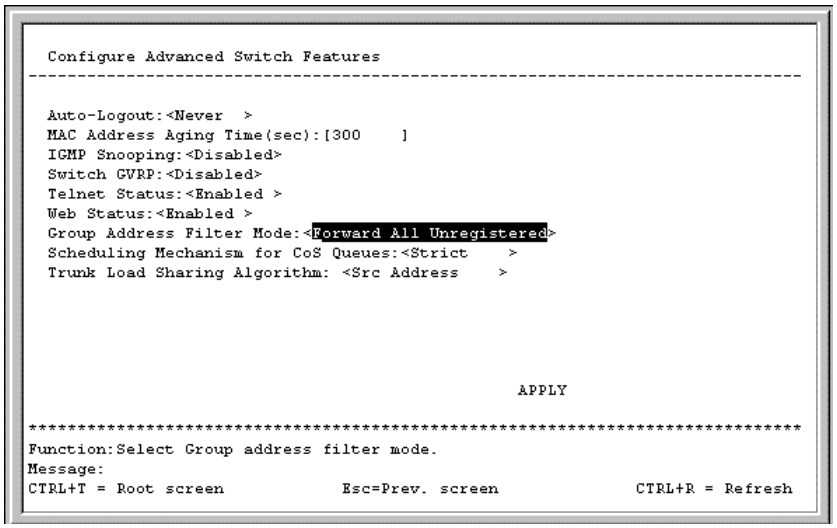


Figure 6-13. Configure Advanced Switch Features screen

This screen allows you to set the following features:

- **Auto-Logout:<***Never***> –** This sets the time the interface can be idle before the Switch automatically logs-out the user. The options are *2 mins*, *5 mins*, *10 mins*, *15 mins*, or *Never*.

- **MAC Address Aging Time (sec):[***300* **] –** This field specifies the length of time a learned MAC Address will remain in the forwarding table without being accessed (that is, how long a learned MAC Address is allowed to remain idle). The Aging Time can be set to any value between 10 and 1,000,000 seconds.

  Note: *A very long Aging Time can result with the out-of-date Dynamic Entries that may cause incorrect packet filtering/forwarding decisions. A very short aging time may cause entries to be aged out to soon, resulting in a high percentage of received packets whose source addresses cannot be found in the address table, in which case the Switch will broadcast the packet to all ports, negating many of the benefits of having a Switch.*

- **IGMP Snooping**:**<***Disabled***> –** This setting enables Internet Group Management Protocol (IGMP) Snooping, which enables the Switch to read IGMP packets being forwarded through the Switch in order to obtain forwarding information from them (learn which ports contain Multicast members.

- **Switch GVRP:<***Enabled***> –** Group VLAN Registration Protocol is a protocol that allows members to dynamically join VLANs. This is used to enable or disable GVRP on the Switch

- **Telnet Status:<***Enabled***> –** Toggle to *Enabled* to allow access to the Switch over the network using the TCP/IP Telnet protocol.

- **Web Status:<***Enabled***> –** You can also use a Web-based browser to manage the Switch by toggling to *Enabled*.

- **Group Address Filter Mode:<***Forward All Unregistered***> –** The IGMP filter mode for processing multicast packets. The options are *Forward All*, *Forward All Unregistered*, and *Filtered All Unregistered*.

- **Scheduling Mechanism for CoS Queues:<***Strict***> –** There are two Class of Service queue options, *RoundRobin* and *Strict*. If *Strict* is selected, when the highest priority queue is full, those packets will be the first to be forwarded. If *RoundRobin* is selected, the forwarding is based on the settings made on the **Class of Service Configuration** screen.

- **Trunk Load Sharing Algorithm:<***Src Address***> –** The trunk load sharing options are *Dst Address*, *Src&Dst Address*, and *Src Address*.

Configure Ports

Highlight **Configure Ports** from the **Configuration** menu and press **Enter**:

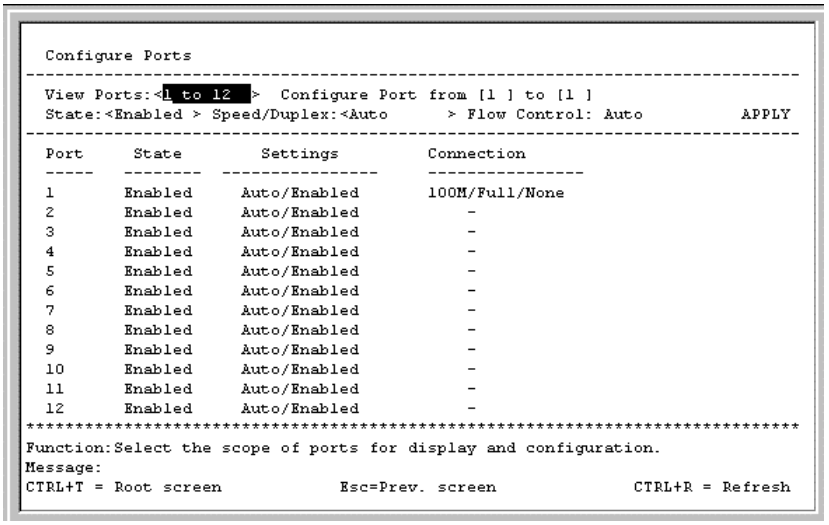

Configure Ports
View Ports:<1 to 12 > Configure Port from [1] to [1]
State:<Enabled > Speed/Duplex:<Auto > Flow Control: Auto APPLY
Port State Settings Connection
1 Enabled Auto/Enabled 100M/Full/None
2 Enabled Auto/Enabled -
3 Enabled Auto/Enabled -
4 Enabled Auto/Enabled -
5 Enabled Auto/Enabled -
6 Enabled Auto/Enabled -
7 Enabled Auto/Enabled -
8 Enabled Auto/Enabled -
9 Enabled Auto/Enabled -
10 Enabled Auto/Enabled -
11 Enabled Auto/Enabled -
12 Enabled Auto/Enabled -
Function:Select the scope of ports for display and configuration.
Message:
CTRL+T = Root screen Esc=Prev. screen CTRL+R = Refresh

Figure 6-14. Configure Ports screen

Toggle the **View Ports:<***1 to 12* **>** field, using the space bar, to view the configuration of either ports 1 through 12 or ports 13 through 24. To configure a specific port, toggle the **Configure Port from [ ]** to **[ ]** field until the appropriate port number or port range appears.

Toggle the **State:< >** field to either enable or disable a given port.

Toggle the **Speed/Duplex:< >** field to select the speed and duplex/half-duplex state of the port. *Auto* means auto-negotiation between 10 and 100 Mbps devices, in full- or half-duplex mode. The Auto setting allows the port to automatically determine the fastest settings the device the port is connected to can handle, and then to use those settings. The other options are *100M/Full*, *100M/Half*, *10M/Full*, *10M/Half*. There is no automatic adjustment of port settings with any option other than *Auto*. **Flow Control** can be enabled manually when either *100M/Full* or *10M/Full* is selected.

Configure Bandwidth

The **Bandwidth Configuration** menu allows you to access screens that set and display the Ingress bandwidth and Egress bandwidth of specified ports on the Switch.

Highlight **Configure Bandwidth** on the **Configuration** menu and press **Enter**:

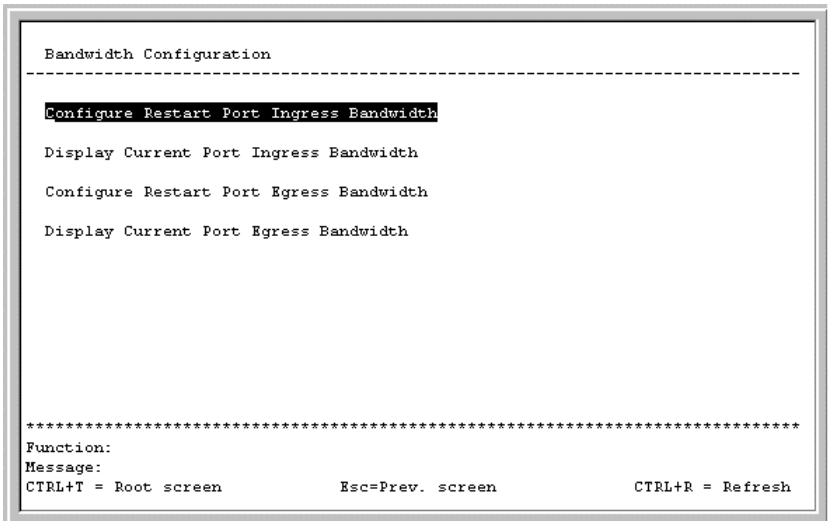


Figure 6-15. Bandwidth Configuration screen

To configure port ingress bandwidth, highlight **Configure Restart Port Ingress Bandwidth** on the screen above and click **Enter**:

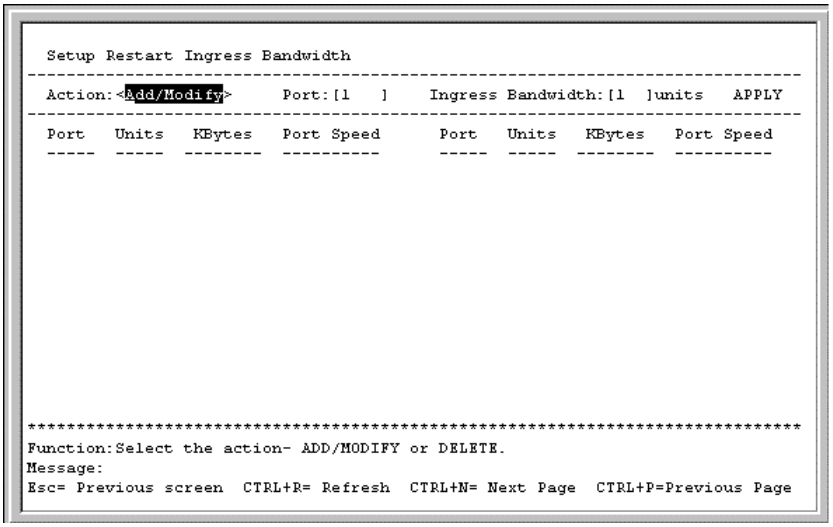


Figure 6-16. Setup Restart Ingress Bandwidth screen

To configure ingress bandwidth for a specific port, select *Add/Modify* in the first field, specify a port in the next field, and then enter a bandwidth between 1 and 127. Click APPLY, save the changes, and then reboot the Switch to let your changes take effect. To delete an entry, toggle the **Action** field to *Delete*.

To view port ingress bandwidth settings, highlight **Display Current Port Ingress Bandwidth** on the **Bandwidth Configuration** menu and click **Enter**.

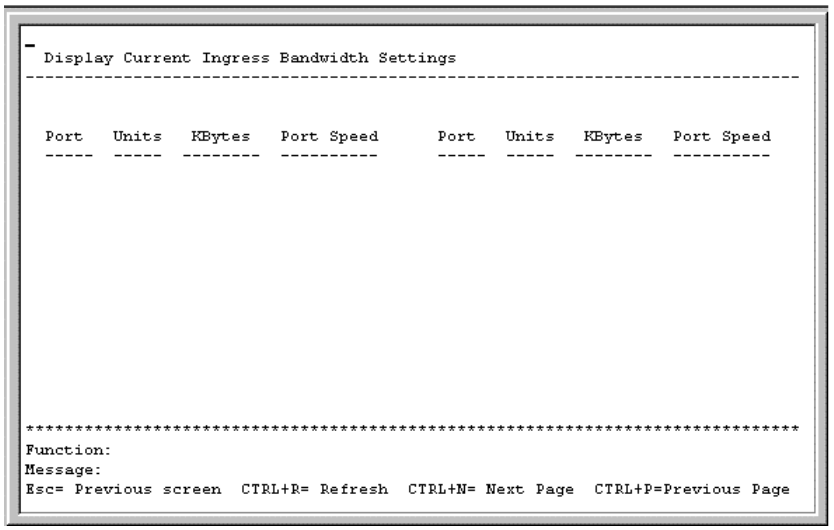

Display Current Ingress Bandwidth Settings
Port Units KBytes Port Speed Port Units KBytes Port Speed
Function:
Message:
Esc= Previous screen CTRL+R= Refresh CTRL+N= Next Page CTRL+P=Previous Page

Figure 6-17. Display Current Ingress Bandwidth Settings screen

This read-only screen displays current ingress bandwidth information.

To configure port egress bandwidth, highlight **Configure Restart Port Egress Bandwidth** on the **Bandwidth Configuration** screen and click **Enter**:

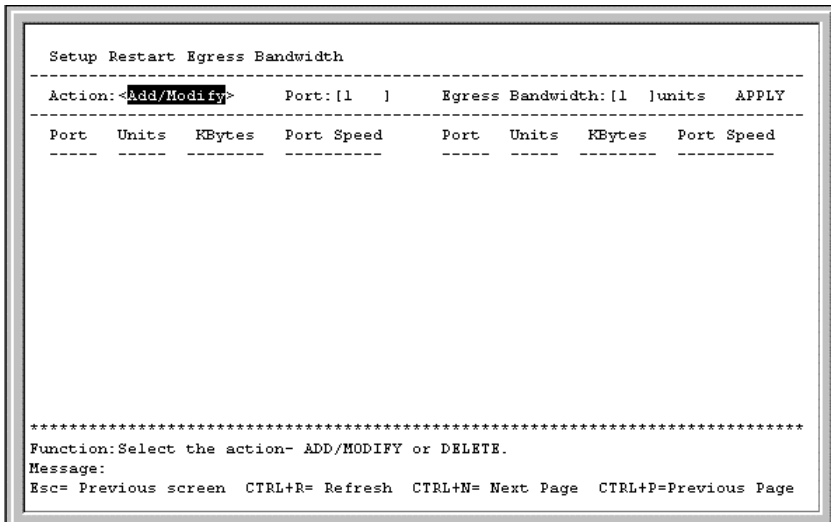

Setup Restart Egress Bandwidth
Action:<Add/Modify> Port:[1] Egress Bandwidth:[1]units APPLY
Port Units KBytes Port Speed Port Units KBytes Port Speed
Function:Select the action- ADD/MODIFY or DELETE.
Message:
Esc= Previous screen CTRL+R= Refresh CTRL+N= Next Page CTRL+P=Previous Page

Figure 6-18. Setup Restart Egress Bandwidth screen

To configure egress bandwidth for a specific port, select *Add/Modify* in the first field and specify a port in the next field (between ports 1 and 24). Finally, enter a bandwidth between 1 and 127 in the last field. Click APPLY, save the changes, and then reboot the Switch to let your changes take effect. To delete an entry, toggle the **Action** field to *Delete*.

To view port egress bandwidth settings, highlight **Display Current Port Egress Bandwidth** on the **Bandwidth Configuration** menu and click **Enter**.

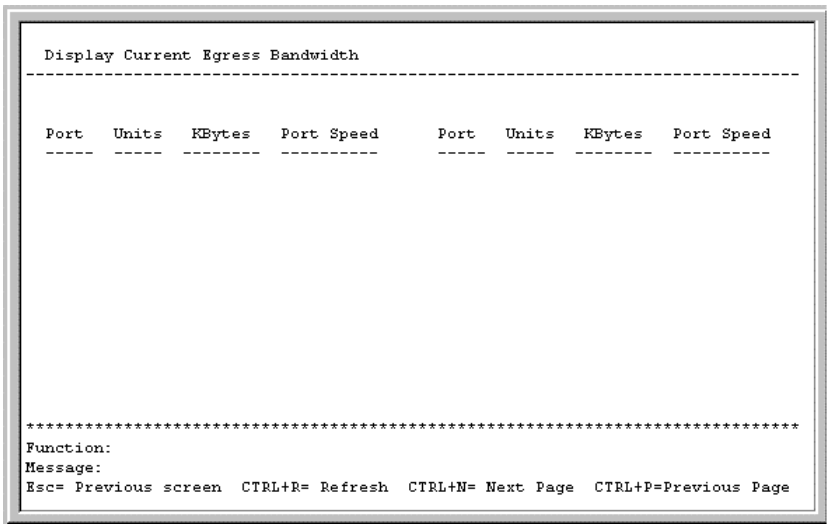

Display Current Egress Bandwidth
Port Units KBytes Port Speed Port Units KBytes Port Speed
Function:
Message:
Esc= Previous screen CTRL+R= Refresh CTRL+N= Next Page CTRL+P=Previous Page

Figure 6-19. Display Current Egress Bandwidth screen

This read-only screen displays current egress bandwidth information.

Configure Spanning Tree Protocol

To globally configure STP on the Switch, highlight **Configure Spanning Tree Protocol** on the **Configuration** menu and press **Enter**:

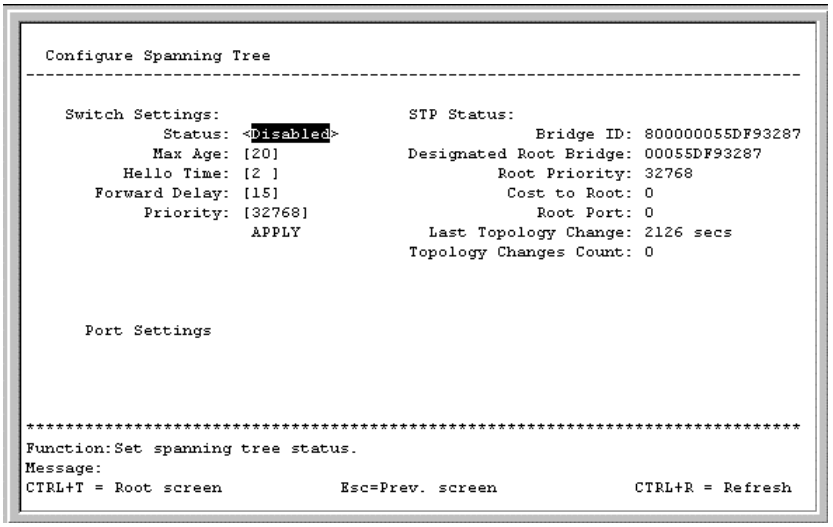


Figure 6-20. Configure Spanning Tree menu

The Spanning Tree Protocol (STP) operates on two levels: on the switch level, the settings are globally implemented. On the port level, the settings are implemented on a per user-defined group basis.

> ***Note:*** *The factory default settings should cover the majority of installations. Therefore, it is advisable to keep the default settings as set at the factory unless it is absolutely necessary to change them.*

The user-changeable parameters in the Switch are as follows:

- **Status:<***Disabled***>** – Toggle to *Enabled* to implement the Spanning Tree Protocol on the Switch.

- **Max Age: [***20***]** – The Maximum Age can be set from 6 to 40 seconds. At the end of the Max Age, if a BPDU has still not been received from the Root Bridge, your Switch will start sending its own BPDU to all other Switches for permission to become the Root Bridge. If it turns out that your Switch has the lowest Bridge Identifier, it will become the Root Bridge.

- **Hello Time: [***2* **]** – The Hello Time can be set from 1 to 10 seconds. This is the interval between two transmissions of BPDU packets sent by the Root Bridge to tell all other Switches that it is indeed the Root Bridge. If you set a Hello Time for your Switch, and it is not the Root Bridge, the set Hello Time will be used if and when your Switch becomes the Root Bridge.

  Note: *The Hello Time cannot be longer than the Max. Age. Otherwise, a configuration error will occur.*

- **Forward Delay: [***15***]** – The Forward Delay can be from 4 to 30 seconds. This is the time any port on the Switch spends in the listening state while moving from the blocking state to the forwarding state.

- **Priority: [***32768***]** – A Priority for the switch can be set from 0 to 65535. 0 is equal to the highest Priority. This number is used in the voting process between switches on the network to determine which switch will be the root switch. A low number indicates a high priority, and a high probability that this switch will be elected as the root switch.

  Note: *Observe the following formulas when setting the above parameters:*

  Max. Age 2 x (Forward Delay - 1 second)
  Max. Age 2 x (Hello Time + 1 second)

Port Spanning Tree Settings

In addition to setting Spanning Tree parameters for use on the switch level, the DES-3226 allows for the configuration of Spanning Tree Protocol on individual ports.

To define individual ports, highlight **Port Settings** on the **Configure Spanning Tree** menu above and press **Enter**.

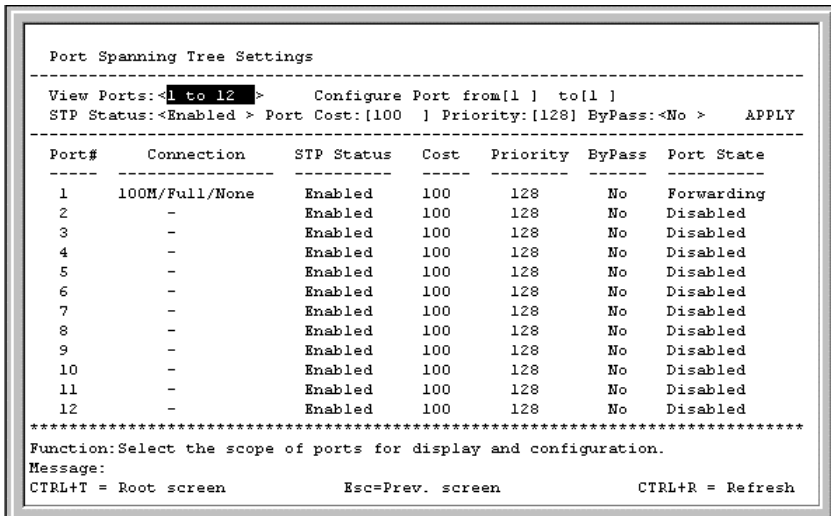

Port Spanning Tree Settings
View Ports:<1 to 12 > Configure Port from[1] to[1]
STP Status:<Enabled > Port Cost:[100] Priority:[128] ByPass:<No > APPLY
Port# Connection STP Status Cost Priority ByPass Port State
1 100M/Full/None Enabled 100 128 No Forwarding
2 - Enabled 100 128 No Disabled
3 - Enabled 100 128 No Disabled
4 - Enabled 100 128 No Disabled
5 - Enabled 100 128 No Disabled
6 - Enabled 100 128 No Disabled
7 - Enabled 100 128 No Disabled
8 - Enabled 100 128 No Disabled
9 - Enabled 100 128 No Disabled
10 - Enabled 100 128 No Disabled
11 - Enabled 100 128 No Disabled
12 - Enabled 100 128 No Disabled
Function:Select the scope of ports for display and configuration.
Message:
CTRL+T = Root screen Esc=Prev. screen CTRL+R = Refresh

Figure 6-21. Port Spanning Tree Settings screen

Toggle the **View Ports:<** **>** field to the range of ports to be configured. The Fast Ethernet ports displayed for configuration in groups of 12 and the optional 100BASE ports are displayed together—if a 2-port rather than 1-port extension module is installed. Enter the port number or port range in the **Configure Port from [ ] to [ ]** field. After enabling or disabling **STP Status**, you can set the spanning tree port cost and priority. Toggle the **Bypass** field to *Yes* if you want to enable the Switch to skip the usual waiting time associated with the listening state.

Configure Static (Destination-Address Filtering) Table

The **Configure Static (Destination-Address Filtering) Table** menu allows you to access screens to create, modify, and delete both Static Unicast Filtering Table and Static Multicast Filtering Table entries, respectively.

Highlight **Configure Static (Destination-Address Filtering) Table** on the **Configuration** menu and press **Enter**:

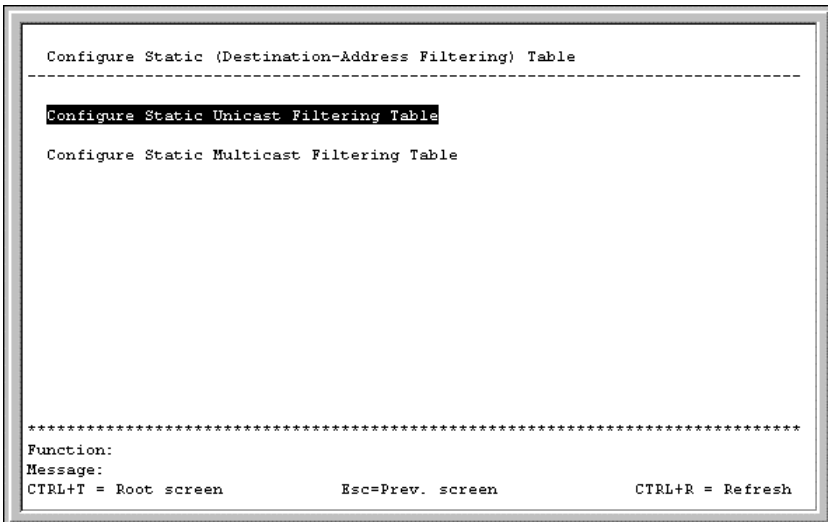


Figure 6-22. Configure Static (Destination-Address Filtering) Table menu

Setup Unicast Filtering Table

Highlight **Configure Static Unicast Filtering Table** on the menu above to access the following screen:

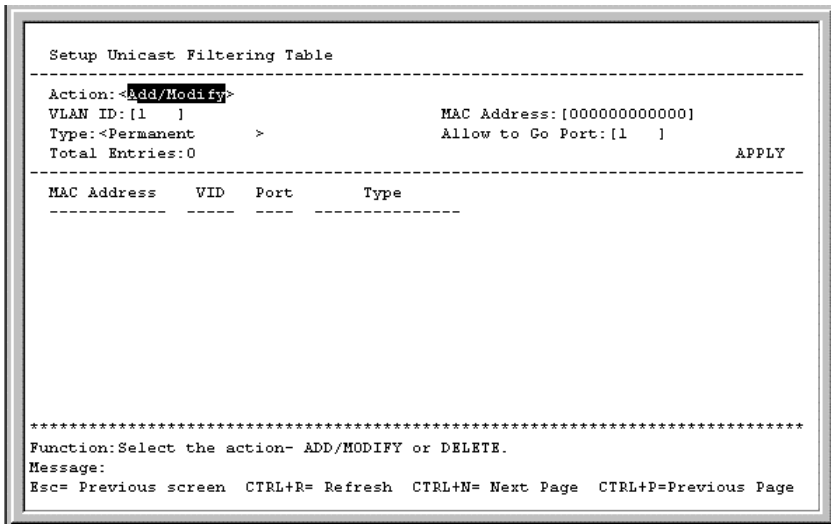


Figure 6-23. Setup Unicast Filtering Table screen

The **Action** field can be toggled between *Add/Modify* and *Delete* using the space bar. Enter the VID in the **VLAN ID** field and the MAC address to be statically entered in the forwarding table in the **MAC Address** field. There are two static unicast filter types to select from, *Permanent* and *DeleteOnReset*. Enter the port number in the **Allow to Go Port** field.

Highlight APPLY and press **Enter** to make the changes current. Use **Save Changes** from the main menu to enter the changes into NV-RAM.

Setup Static Multicast Filtering Table

To edit the IEEE 802.1q Multicast Filtering settings, highlight **Configure Static Multicast Filtering Table** on the **Configure Static (Destination-Address Filtering) Table** menu above to access the following screen:

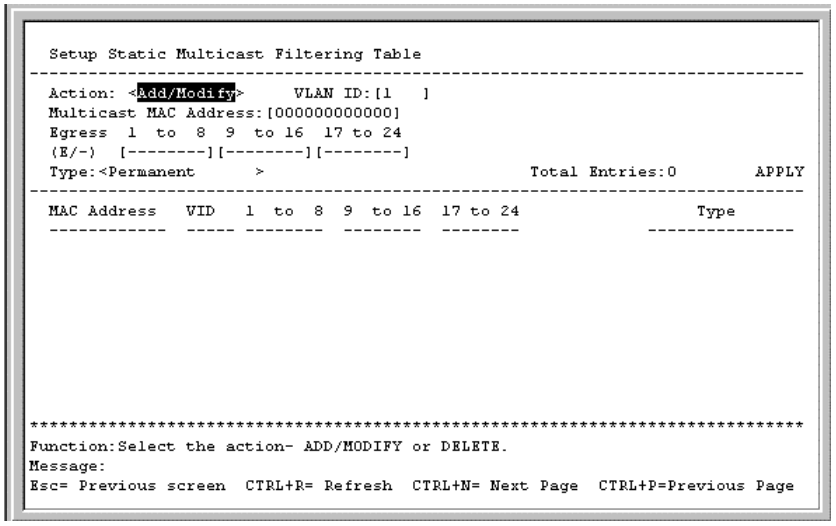

Setup Static Multicast Filtering Table
Action: <Add/Modify>
VLAN ID:[1]
Multicast MAC Address:[000000000000]
Egress 1 to 8 9 to 16 17 to 24
(E/-) [--------][--------][--------]
Type:<Permanent >
Total Entries:0
APPLY
MAC Address VID 1 to 8 9 to 16 17 to 24
Type
Function:Select the action- ADD/MODIFY or DELETE.
Message:
Esc= Previous screen CTRL+R= Refresh CTRL+N= Next Page CTRL+P=Previous Page

Figure 6-24. Setup Static Multicast Filtering Table screen

The **Action** field can be toggled between *Add/Modify* and *Delete* using the space bar. To add a new entry to the static multicast filtering table, select *Add/Modify* and enter the VLAN ID number of the VLAN that will be receiving the multicast packets. Enter the MAC address of the multicast source, and then enter the member ports. Each port can be an Egress or a Non-member of the multicast group, on a per-VLAN basis. There are two static multicast filter types to select from, *Permanent* and *DeleteOnReset*.

To set a port's multicast group membership status, highlight the first field of **(***E***/-)**. Each port's multicast group membership can be set individually by highlighting the port's entry using the arrow keys, and then toggling between *E* and – using the space bar.

- *E* (Egress Member) – Specifies the port as being a static member of the multicast group. Egress Member Ports are ports that will be transmitting traffic for the multicast group.
- – (Non-Member) – Specifies the port as not being a member of the multicast group, but the port can become a member of the multicast group dynamically.

Highlight APPLY and press **Enter** to make the changes current. Use **Save Changes** from the main menu to enter the changes into NV-RAM.

Configure VLANs

The Switch reserves one VLAN, VID = 1, called the DEFAULT_VLAN for internal use. The factory default setting assigns all ports on the Switch to the DEFAULT_VLAN. As new VLANs are configured, their respective member ports are removed from the DEFAULT_VLAN. If the DEFAULT_VLAN is reconfigured, all ports are again assigned to it. Ports that are not wanted as part of the DEFAULT_VLAN are removed during the configuration.

Packets cannot cross VLANs. If a member of one VLAN wants to connect to another VLAN, it must be through a router.

Note: *The Switch's default is to assign all ports to a single 802.1Q VLAN named* DEFAULT_VLAN*. As new VLANs are created, the member ports assigned to the new VLAN will be removed from the default VLAN port member list.*

Note*: The* DEFAULT_VLAN *has a VID = 1. An IP interface called System in the IP interface entry menu also has a VID = 1, and therefore corresponds to the* DEFAULT_VLAN.

To create a new 802.1Q VLAN*:*

The VLAN menu adds an entry to edit the VLAN definitions and to configure the port settings for IEEE 802.1Q VLAN support. Highlight **Configure VLANs** from the **Configuration** menu and press **Enter**.

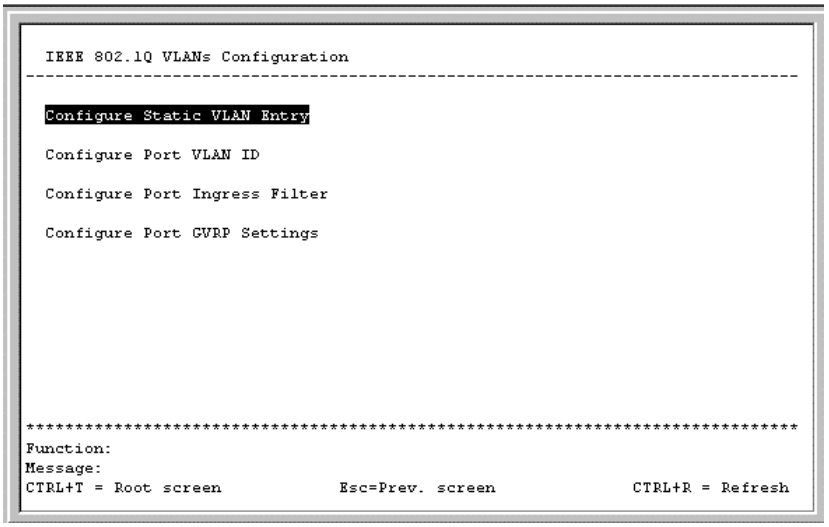


Figure 6-25. IEEE 802.1Q VLANs Configuration menu

802.1Q Static VLAN Settings

To create an 802.1Q VLAN, highlight **Configure Static VLAN Entry** and press **Enter**:

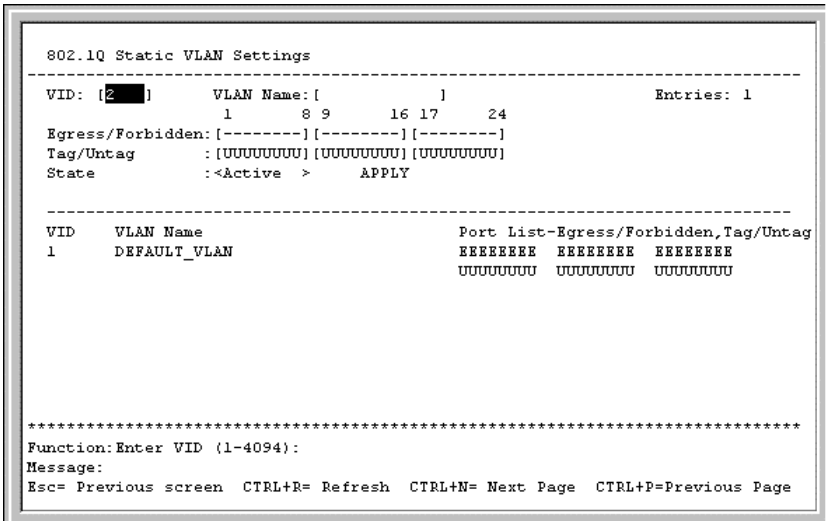


Figure 6-26. 802.1Q Static VLAN Settings screen

To create an 802.1Q VLAN, enter a VLAN ID number in the **VID** field and a name for the new VLAN in the **VLAN Name** field.

To set the 802.1Q VLAN membership status of a port:

To enter the 802.1Q VLAN status for a port, highlight the first field of **Egress/Forbidden**. Each port's 802.1Q VLAN membership can be set individually by highlighting the port's entry using the arrow keys, and then toggling between *E* and – using the space bar.

- *E* (Egress Member) – Specifies the port as being a static member of the VLAN. Egress Member Ports are ports that will be transmitting traffic for the VLAN. These ports can be either tagged or untagged.
- *F* (Forbidden Non-Member) – Defines the port as a non-member and also forbids the port from joining a VLAN dynamically.
- – (Non-Member) – Specifies the port as not being a member of the VLAN, but the port can become a member of the VLAN dynamically.

Next, determine which of the ports that are members of the new VLAN will be Tagged or Untagged ports.

To set a port as either a Tagged or an Untagged port:

Highlight the first field of **Tag/Untag** field. Each port's state can be set by highlighting the port's entry using the arrow keys and then toggling between U or T using the space bar.

- *U* - specifies the port as an Untagged member of the VLAN. When an untagged packet is transmitted by the port, the packet header remains unchanged. When a tagged packet exits the port, the tag is stripped and the packet is changed to an untagged packet.
- *T* - specifies the port as a Tagged member of the VLAN. When an untagged packet is transmitted by the port, the packet header is changed to include the 32-bit tag associated with the PVID (Port VLAN Identifier – see below). When a tagged packet exits the port, the packet header is unchanged.

If the port is attached to a device that is not IEEE 802.1Q VLAN compliant (VLAN-tag unaware), then the port should be set to U – Untagged.

If the port is attached to a device that is IEEE 802.1Q VLAN compliant, (VLAN-tag aware), then the port should be set to T – Tagged.

Once you have toggled between *Active* and *Inactive* under **State**, press APPLY to make the additions or deletions effective for the current session. To enter the changes into Non-volatile RAM, highlight **Save Changes** from the main menu and press **Enter**.

In the following example screen, the VLAN "Accounting" – VID # 2 – has been added. Ports 1, 2, 14, 16, and 17 are Egress ports (static members of "Accounting").

Example of 802.1Q VLAN:

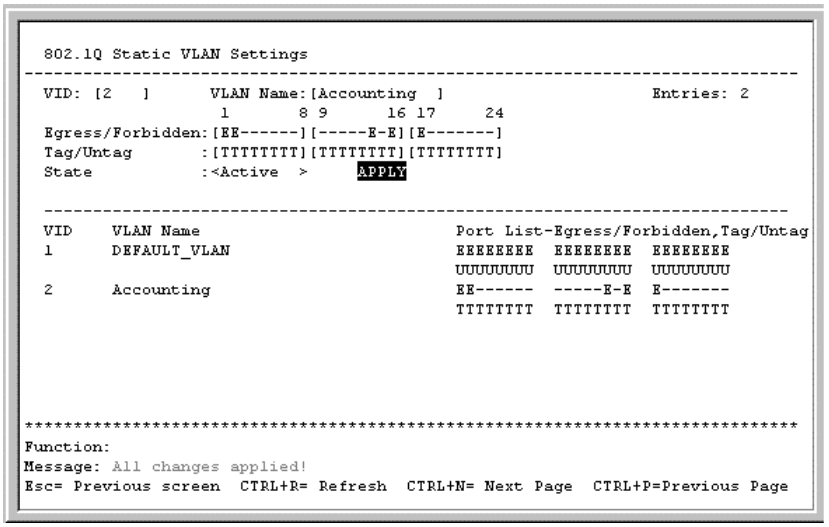

802.1Q Static VLAN Settings
VID: [2] VLAN Name:[Accounting] Entries: 2
1 8 9 16 17 24
Egress/Forbidden:[EE------][-----E-E][E-------]
Tag/Untag :[TTTTTTTT][TTTTTTTT][TTTTTTTT]
State :<Active > APPLY
VID VLAN Name Port List-Egress/Forbidden,Tag/Untag
1 DEFAULT_VLAN EEEEEEEE EEEEEEEE EEEEEEEE
UUUUUUUU UUUUUUUU UUUUUUUU
2 Accounting EE------ -----E-E E-------
TTTTTTTT TTTTTTTT TTTTTTTT
Function:
Message: All changes applied!
Esc= Previous screen CTRL+R= Refresh CTRL+N= Next Page CTRL+P=Previous Page

Figure 6-27. 802.1Q Static VLAN Settings screen

Port VLAN assignment

To assign a port a PVID, highlight **Configure Port VLAN ID** on the **IEEE 802.1Q VLANs Configuration** menu and press **Enter**:

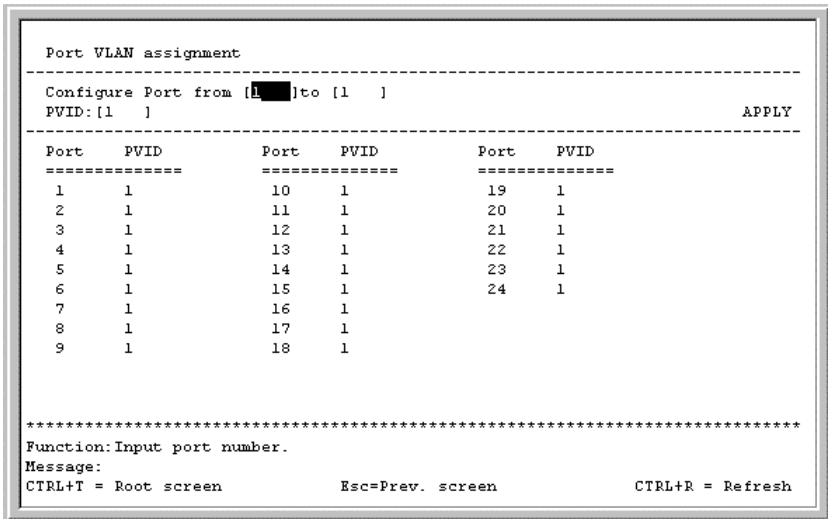

Port VLAN assignment
Configure Port from [1]to [1]
PVID:[1] APPLY
Port PVID Port PVID Port PVID
1 1 10 1 19 1
2 1 11 1 20 1
3 1 12 1 21 1
4 1 13 1 22 1
5 1 14 1 23 1
6 1 15 1 24 1
7 1 16 1
8 1 17 1
9 1 18 1
Function:Input port number.
Message:
CTRL+T = Root screen Esc=Prev. screen CTRL+R = Refresh

Figure 6-28. Port VLAN assignment screen

Highlight the **Configure Port from [***1* **] to [***1* **]** field and enter the range of port numbers you want to configure. Next, highlight the **PVID** field and enter the PVID for the VLAN's member ports you want to configure.

Port VLAN Identifier (PVID) is a classification mechanism that associates a port with a specific VLAN and is used to make forwarding decisions for untagged packets received by the port. For example, if port #2 is assigned a PVID of 3, then all untagged packets received on port #2 will be assigned to VLAN 3. This number is generally the same as the VID# number assigned to the port in the **802.1Q Static VLAN Settings** screen above.

Ingress Filter Settings

To set ingress filtering on a port, highlight **Configure Port Ingress Filter** on the **IEEE 802.1Q VLANs Configuration** menu and press **Enter**:

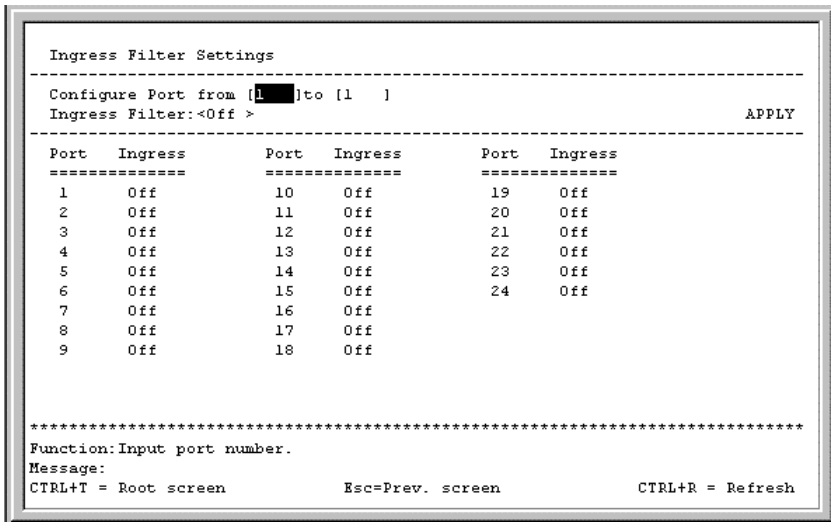

Ingress Filter Settings
Configure Port from [1]to [1]
Ingress Filter:<Off >
APPLY
Port Ingress Port Ingress Port Ingress
1 Off 10 Off 19 Off
2 Off 11 Off 20 Off
3 Off 12 Off 21 Off
4 Off 13 Off 22 Off
5 Off 14 Off 23 Off
6 Off 15 Off 24 Off
7 Off 16 Off
8 Off 17 Off
9 Off 18 Off
Function:Input port number.
Message:
CTRL+T = Root screen
Esc=Prev. screen
CTRL+R = Refresh

Figure 6-29. Ingress Filter Settings screen

Highlight the **Configure Port from [***1* **] to [***1* **]** field and enter the range of port numbers you want to configure. Then use the space bar to toggle between *On* and *Off* in the **Ingress Filter** field.

An Ingress Filter enables the port to compare the VID tag of an incoming packet with the PVID number assigned to the port. If the two are different, the port filters (drops) the packet.

Port GVRP Settings

GARP VLAN Registration Protocol (GVRP) is a Generic Attribute Registration Protocol (GARP) application that provides 802.1Q-compliant VLAN pruning and dynamic VLAN creation on 802.1Q trunk ports. With GVRP, the Switch can exchange VLAN configuration information with other GVRP switches, prune unnecessary broadcast and unknown unicast traffic, and dynamically create and manage VLANs on switches connected through 802.1Q trunk ports.

To enable a port to dynamically become a member of a VLAN, highlight **Configure Port GVRP Settings** on the **IEEE 802.1Q VLANs Configuration** menu and press **Enter**:

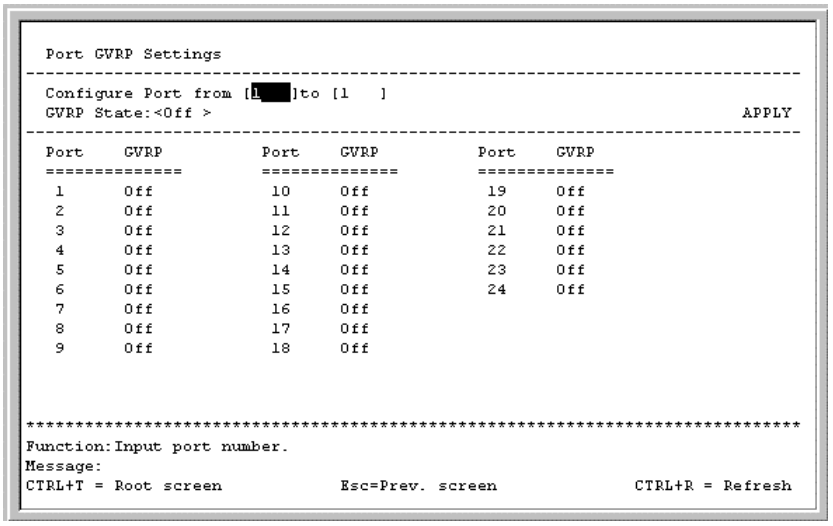

Port GVRP Settings
Configure Port from [1]to [1]
GVRP State:<Off >
APPLY
Port GVRP Port GVRP Port GVRP
1 Off 10 Off 19 Off
2 Off 11 Off 20 Off
3 Off 12 Off 21 Off
4 Off 13 Off 22 Off
5 Off 14 Off 23 Off
6 Off 15 Off 24 Off
7 Off 16 Off
8 Off 17 Off
9 Off 18 Off
Function:Input port number.
Message:
CTRL+T = Root screen
Esc=Prev. screen
CTRL+R = Refresh

Figure 6-30. Port GVRP Settings screen

This screen allows you to enable or disable GARP VLAN Registration Protocol (GVRP), where GARP is the Generic Attribute Registration Protocol, on individual ports. Enter the range of ports to be configured in the first two fields and then toggle the GVRP State to *On*. Press APPLY to let your changes take effect.

GVRP updates dynamic VLAN registration entries and communicates the new VLAN information across the network. This allows, among other things, for stations to physically move to other switch ports and keep their same VLAN settings, without having to reconfigure VLAN settings on the Switch.

Configure IGMP Snooping

IGMP Snooping can be globally enabled or disabled from the **IGMP Snooping Settings** screen.

To configure IGMP Snooping, highlight **Configure IGMP Snooping** on the **Configuration** menu and press **Enter**.

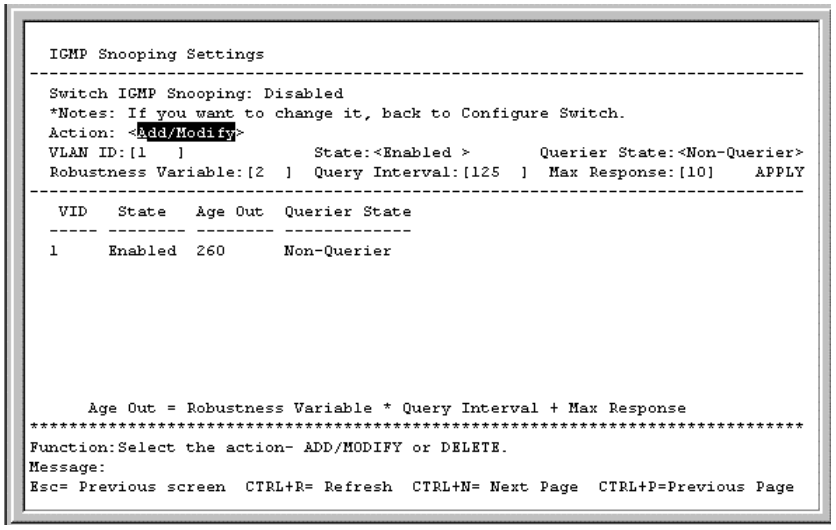

IGMP Snooping Settings
Switch IGMP Snooping: Disabled
*Notes: If you want to change it, back to Configure Switch.
Action: <Add/Modify>
VLAN ID:[1] State:<Enabled > Querier State:<Non-Querier>
Robustness Variable:[2] Query Interval:[125] Max Response:[10] APPLY
VID State Age Out Querier State
1 Enabled 260 Non-Querier
Age Out = Robustness Variable * Query Interval + Max Response
Function:Select the action- ADD/MODIFY or DELETE.
Message:
Esc= Previous screen CTRL+R= Refresh CTRL+N= Next Page CTRL+P=Previous Page

Figure 6-31. IGMP Snooping Settings screen

To configure IGMP Snooping:

Toggle the **Switch IGMP Snooping** field to *Enabled*. Toggle the **Querier State** field to the appropriate choice between *Non-Querier*, *V1-Querier*, and *V2-Querier* to determine the version of IGMP that is used in your network. A value between 1 and 255 can be entered for the **Robustness Variable** (default is 2). The **Query Interval** can be set between 1 and 65500 seconds (default is 125 seconds). This sets the time between IGMP queries. The **Max Response** allows a setting between 1 and 25 seconds (default is 10) and specifies the maximum amount of time allowed before sending a response report.

Highlight APPLY and press **Enter** to make the settings effective.

The user-changeable parameters in the Switch are as follows:

- **Switch IGMP Snooping:<***Disabled***>** – This field can be toggled using the space bar between *Disabled* and *Enabled*. This is used to enable or disable IGMP Snooping, globally, on the Switch.
- **Action**:<*Add/Modify*> – Toggle to the desired option, *Add/Modify* or *Delete*.
- **VLAN ID:[***1***]** – Enter the appropriate VLAN ID in this field.
- **State:**<*Enabled*> – Toggle this field to *Enabled* to activate this entry.
- **Querier State:<***Non-Querier***>** – This field can be toggled between *Non-Querier*, *V1-Querier*, and *V2-Querier*. This is used to specify the IGMP version (1 or 2) that will be used by the IGMP interface when making queries.

- **Robustness Variable:[***2* **]** – A tuning variable to allow for sub-networks that are expected to lose a large number of packets. A value between 1 and 255 can be entered, with larger values being specified for sub-networks that are expected to lose larger numbers of packets.
- **Query Interval:[***125* **]** – Allows the entry of a value between 1 and 65500 seconds, with a default of 125 seconds. This specifies the length of time between sending IGMP queries.
- **Max Response:[***10***]** – Sets the maximum amount of time allowed before sending an IGMP response report. A value between 1 and 25 seconds can be entered, with a default of 10 seconds.

Configure Port Trunking

To configure a port trunking group, highlight **Configure Port Trunking** on the **Configuration** menu and press **Enter**.

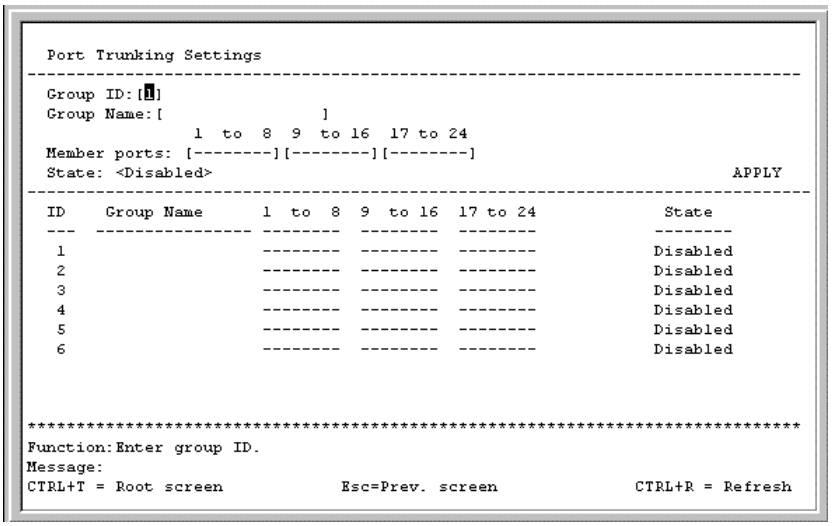


Figure 6-32. Port Trunking Settings screen

Port trunking allows several ports to be grouped together and to act as a single link. This gives a bandwidth that is a multiple of a single link's bandwidth.

Port trunking is most commonly used to link a bandwidth intensive network device or devices – such as a server – to the backbone of a network.

The Switch allows the creation of up to 6 port trunking groups, each group consisting of up to 8 links (ports). The trunked ports can be non-continuous (that is, have non-sequential port numbers). All of the ports in the group must be members of the same VLAN. Further, the trunked ports must all be of the same speed and should be configured as full-duplex.

The configuration of the lowest numbered port in the group becomes the configuration for all of the ports in the port trunking group. This port is called the Master Port of the group, and all configuration options – including the VLAN configuration – that can be applied to the Master Port are applied to the entire port trunking group.

Load balancing is automatically applied to the ports in the trunked group, and a link failure within the group causes the network traffic to be directed to the remaining links in the group.

The Spanning Tree Protocol will treat a port trunking group as a single link, on the switch level. On the port level, the STP will use the port parameters of the Master Port in the calculation of port cost and in determining the state of the port trunking group. If two redundant port trunking groups are configured on the Switch, STP will block one entire group – in the same way STP will block a single port that has a redundant link.

The user-changeable parameters in the Switch are as follows:

- **Group ID:[***1***]** – This field is for a group ID number for the port trunking group.
- **Group Name:[ ]** – Enter a name for the port trunking group.
- **Member ports:[ ][ ] [ ]** – Toggle between *M* to indicate membership of the port trunking group, or a dash (–) to indicate non-membership.
- **State:<***Disabled***>** – This field can be toggled between *Enabled* and *Disabled*. This is used to turn a port trunking group on or off. This is useful for diagnostics, to quickly isolate a bandwidth intensive network device or to have an absolute backup aggregation group that is not under automatic control.

Configure Port Mirroring

The Switch allows you to copy frames transmitted and received on a port and redirect the copies to another port. You can attach a monitoring device to the mirrored port, such as a sniffer or an RMON probe, to view details about the packets passing through the first port. This is useful for network monitoring and troubleshooting purposes.

Choose **Configure Port Mirroring** on the **Configuration** menu to access the following screen:

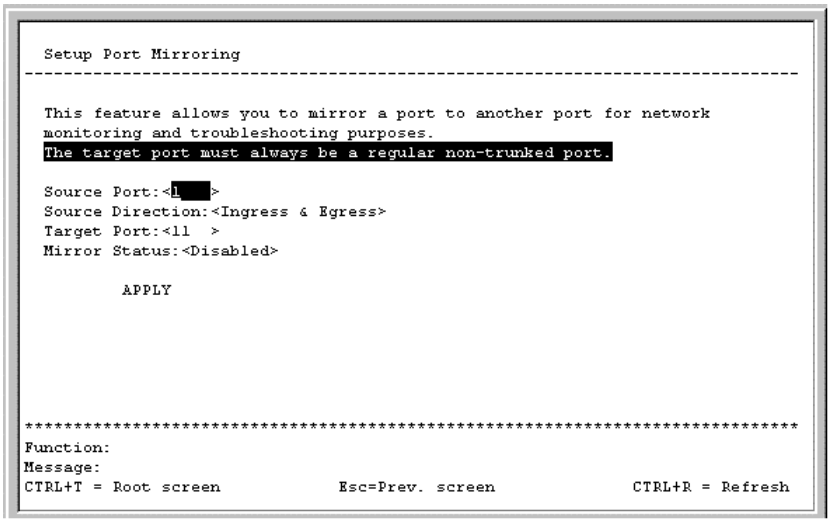


Figure 6-33. Setup Port Mirroring screen

To configure a mirror port, enter the port from where you want to copy frames in the **Source Port** field, select the desired source direction in the next field, and then enter the port which receives the copies from the source port in the **Target Port** field. The target port is where you will connect a monitoring/troubleshooting device such as a sniffer or an RMON probe. Finally, toggle the **Mirror Status** field to *Enabled*, highlight APPLY, and press **Enter**.

Note: You cannot mirror a fast port onto a slower port. For example, if you try to mirror the traffic from a 100 Mbps port onto a 10 Mbps port, this can cause throughput problems. The port you are copying frames from should always support an equal or lower speed than the port to which you are sending the copies. Also, the target port cannot be a member of a trunk group.

Configure Threshold of Broadcast/Multicast/DA-Unknown Storm

To configure the threshold of a broadcast, multicast, or DA (destination address)-Unknown Storm, select **Configure Threshold of Broadcast/Multicast/DA-Unknown Storm** on the **Configuration** menu and press **Enter**.

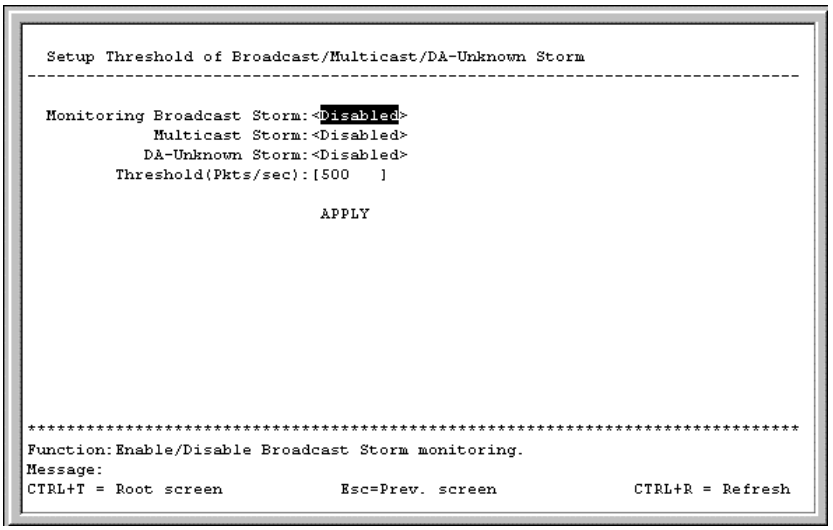


Figure 6-34. Setup Threshold of Broadcast/Multicast/DA-Unknown Storm screen

To use the features on this screen, toggle the desired option to *Enabled*, enter a threshold, and then press **APPLY**.

Configure Port Security

To configure security for a specified port or range of ports on the Switch, select **Configure Port Security** on the **Configuration** menu and press **Enter**.

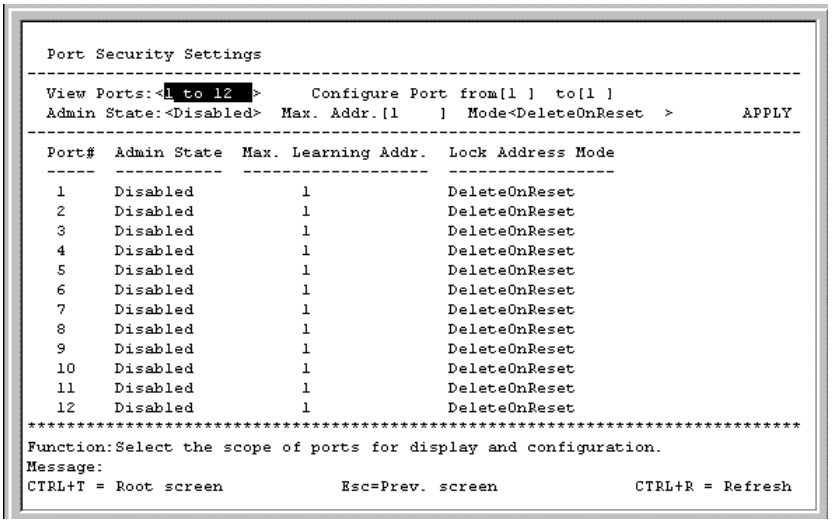

Port Security Settings
View Ports:<1 to 12 >
Configure Port from[1] to[1]
Admin State:<Disabled> Max. Addr.[1] Mode<DeleteOnReset > APPLY
Port# Admin State Max. Learning Addr. Lock Address Mode
1 Disabled 1 DeleteOnReset
2 Disabled 1 DeleteOnReset
3 Disabled 1 DeleteOnReset
4 Disabled 1 DeleteOnReset
5 Disabled 1 DeleteOnReset
6 Disabled 1 DeleteOnReset
7 Disabled 1 DeleteOnReset
8 Disabled 1 DeleteOnReset
9 Disabled 1 DeleteOnReset
10 Disabled 1 DeleteOnReset
11 Disabled 1 DeleteOnReset
12 Disabled 1 DeleteOnReset
Function:Select the scope of ports for display and configuration.
Message:
CTRL+T = Root screen
Esc=Prev. screen
CTRL+R = Refresh

Figure 6-35. Port Security Settings screen

To set up security for a port or ports, toggle **View Ports** to the desired range, enter the port or ports in the next field, toggle Admin State to *Enabled*, enter the maximum number of addresses, the desired **Mode**, and then click **Apply**.

Configure Class of Service, Default Priority and Traffic Class

The DES-3226 allows you to customize class of service, port default priority, and traffic class settings on the following menu.

Select **Configure Class of Service, Default Priority and Traffic Class** on the **Configuration** menu and press **Enter**.

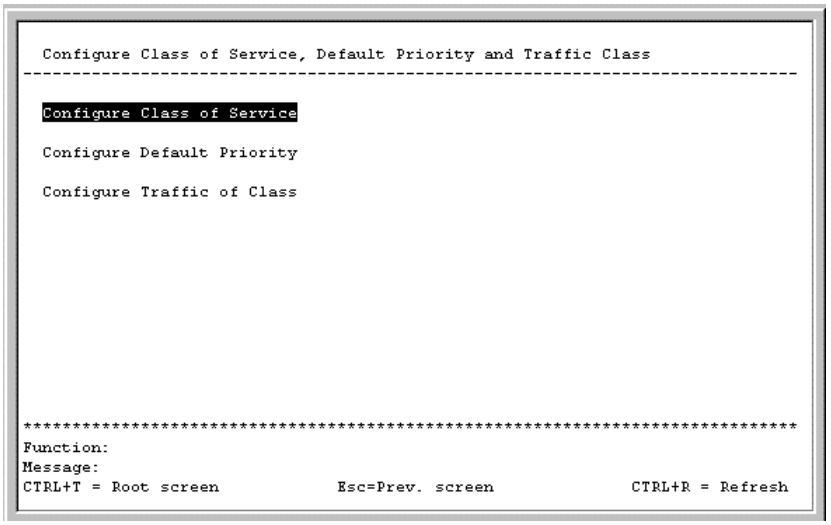


Figure 6-36. Configure Class of Service, Default Priority and Traffic Class menu

Class of Service Configuration

Select **Configure Class of Service** and press **Enter** to access the following screen:

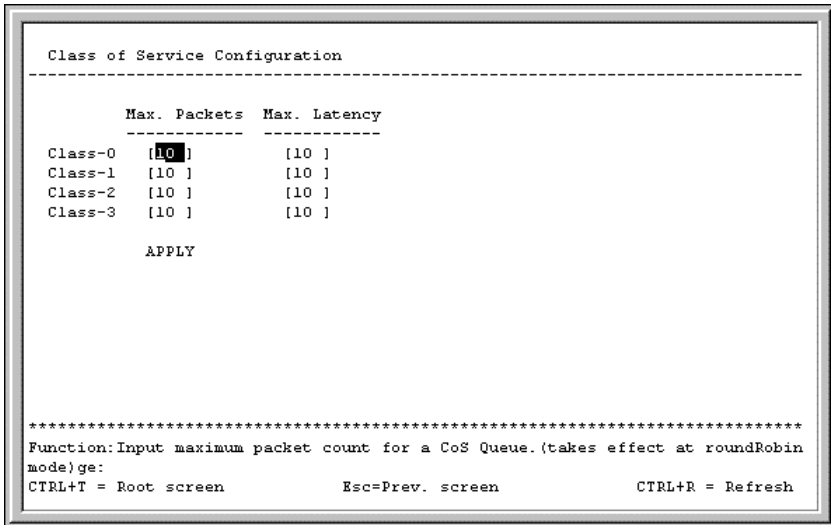

Class of Service Configuration
Max. Packets
Max. Latency
Class-0 [10] [10]
Class-1 [10] [10]
Class-2 [10] [10]
Class-3 [10] [10]
APPLY
Function: Input maximum packet count for a CoS Queue. (takes effect at roundRobin mode) ge:
CTRL+T = Root screen
Esc=Prev. screen
CTRL+R = Refresh

Figure 6-37. Class of Service Configuration screen

This screen allows you to set the following features:

- **Max. Packets** – The Class of Service scheduling algorithm starts from the highest CoS for a given port, sends the maximum number of packets, then moves on to the next lower CoS. The values that can be entered in this field are from 0 to 255. Entering zero instructs the Switch to continue processing packets until there are no more packets in the CoS transaction queue.

- **Max. Latency** – The maximum allowable time a packet will stay in the CoS queue. The packets in this queue are not delayed more than the maximum allowable latency entered in this field. The timer is disabled when this field is set to zero. Each unit of this timer is equal to 17 microseconds.

Port Default Priority assignment

Select **Configure Default Priority** and press **Enter** to access the following screen:

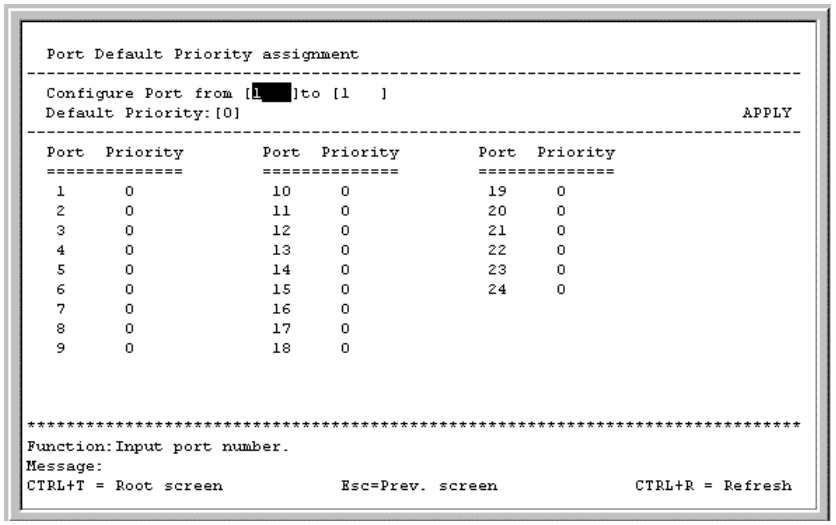

Port Default Priority assignment
Configure Port from [1]to [1]
Default Priority:[0]
APPLY
Port Priority Port Priority Port Priority
1 0 10 0 19 0
2 0 11 0 20 0
3 0 12 0 21 0
4 0 13 0 22 0
5 0 14 0 23 0
6 0 15 0 24 0
7 0 16 0
8 0 17 0
9 0 18 0
Function:Input port number.
Message:
CTRL+T = Root screen
Esc=Prev. screen
CTRL+R = Refresh

Figure 6-38. Port Default Priority assignment screen

This screen allows you to set a default priority for packets that have not already been assigned a priority value. After filling out the two fields offered, press APPLY to let your changes take effect.

Traffic Class Configuration

Select **Configure Traffic of Class** and press **Enter** to access the following screen:

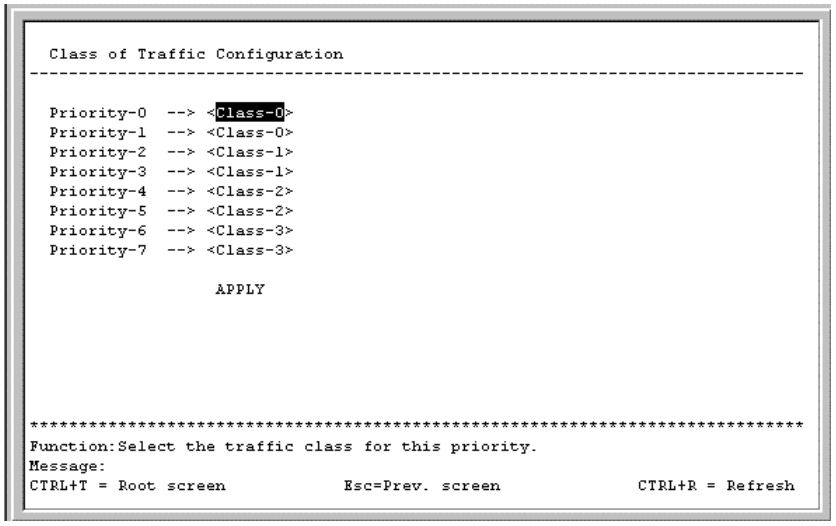


Figure 6-39. Class of Traffic Configuration screen

This screen allows you to configure traffic class priority by specifying the class value, from 0 to 3, of the Switch's eight levels of priority. Press APPLY to let your changes take effect.

Network Monitoring

The DES-3226 provides extensive network monitoring capabilities.

To display the network data compiled by the Switch, highlight **Network Monitoring** on the main menu and press **Enter**.

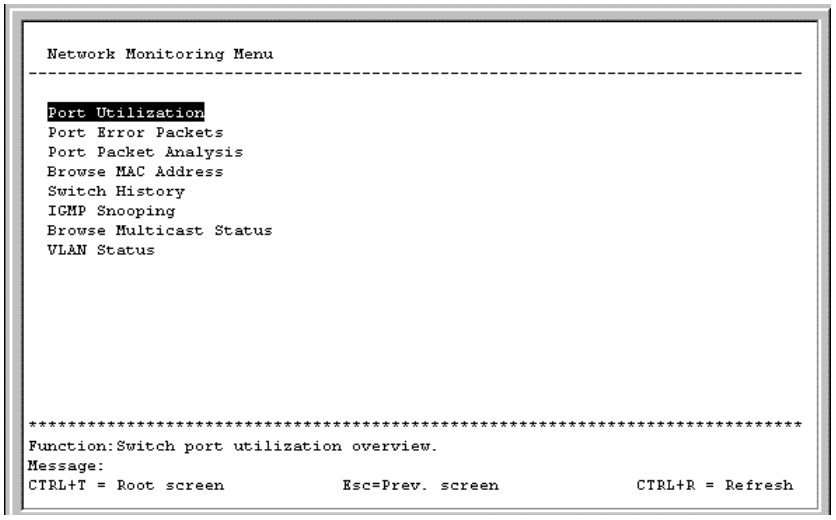


Figure 6-40. Network Monitoring Menu

Port Utilization

To view the port utilization of all the ports on the Switch, highlight **Port Utilization** on the **Network Monitoring Menu** and press **Enter**:

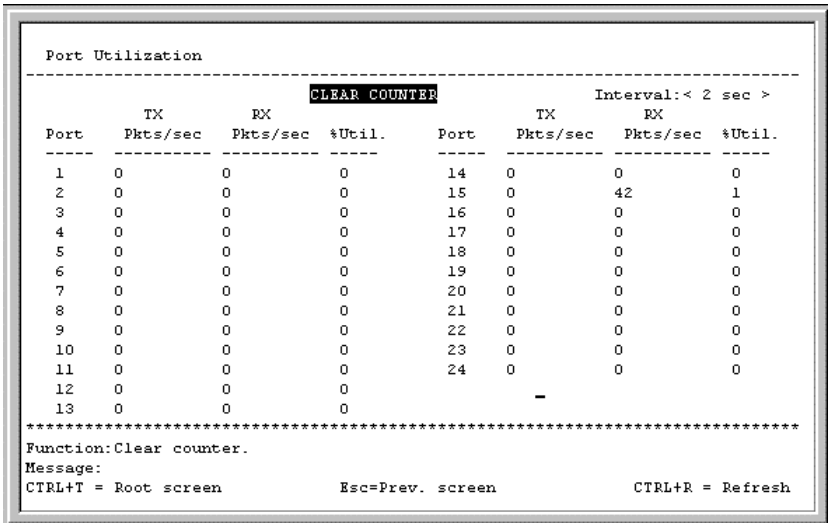


Figure 6-41. Port Utilization screen

The **Port Utilization** screen shows the number of packets transmitted and received per second and calculates the percentage of the total available bandwidth being used on the port (displayed under **%Util.**). Highlight CLEAR COUNTER and press **Enter** to reset the counters.

Port Error Packets

To view the error statistics for a port, highlight **Port Error Packets** on the **Network Monitoring Menu** and press **Enter**:

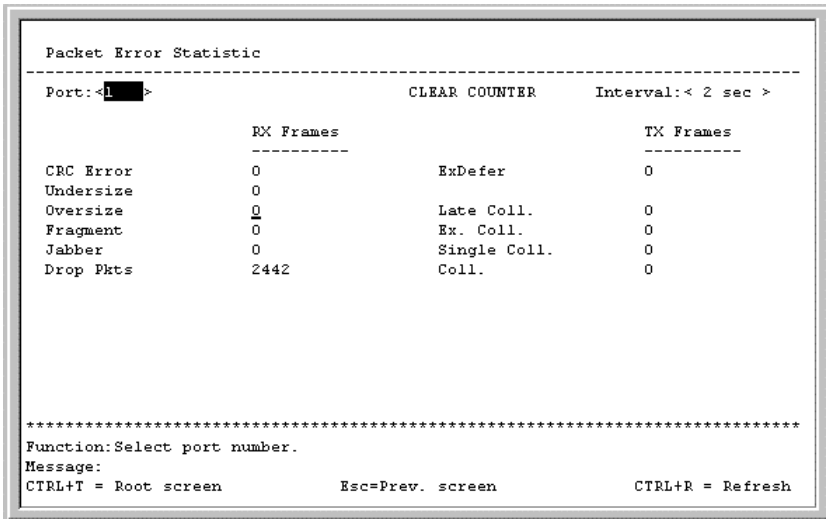


Figure 6-42. Port Error Statistic screen

Enter the port number of the port to be viewed. The **Interval** field can be toggled from 2 seconds to 1 minute, or suspend. This sets the interval at which the error statistics are updated. Highlight CLEAR COUNTER and press **Enter** to reset the counters.

Port Packet Analysis

To view an analysis of the size of packets received or transmitted by a port, highlight **Port Packet Analysis** on the **Network Monitoring Menu** and press **Enter**:

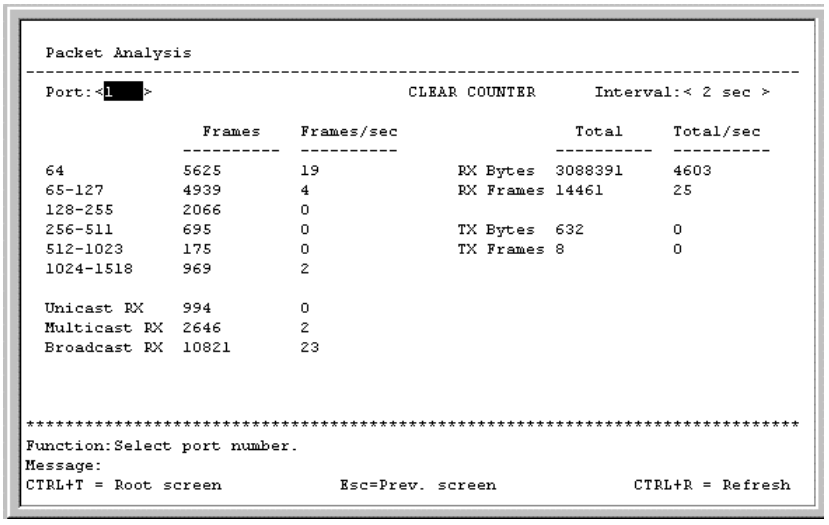


Figure 6-43. Packet Analysis table

In addition to the size of packets received or transmitted by the selected port, statistics on the number of unicast, multicast, and broadcast packets are displayed. Highlight CLEAR COUNTER and press **Enter** to reset the counters.

Browse MAC Address

To view the MAC address forwarding table, highlight **Browse MAC Address** on the **Network Monitoring Menu** and press **Enter**:

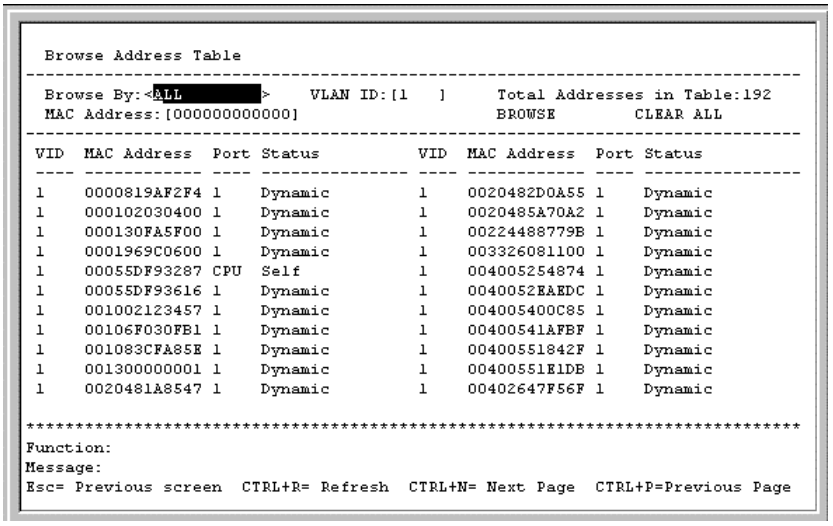

Browse Address Table
Browse By:<ALL >
VLAN ID:[1]
Total Addresses in Table:192
MAC Address:[000000000000]
BROWSE
CLEAR ALL
VID MAC Address Port Status VID MAC Address Port Status
1 0000819AF2F4 1 Dynamic 1 0020482D0A55 1 Dynamic
1 000102030400 1 Dynamic 1 0020485A70A2 1 Dynamic
1 000130FA5F00 1 Dynamic 1 00224488779B 1 Dynamic
1 0001969C0600 1 Dynamic 1 003326081100 1 Dynamic
1 00055DF93287 CPU Self 1 004005254874 1 Dynamic
1 00055DF93616 1 Dynamic 1 0040052EAEDC 1 Dynamic
1 001002123457 1 Dynamic 1 004005400C85 1 Dynamic
1 00106F030FB1 1 Dynamic 1 00400541AFBF 1 Dynamic
1 001083CFA85E 1 Dynamic 1 00400551842F 1 Dynamic
1 001300000001 1 Dynamic 1 00400551E1DB 1 Dynamic
1 0020481A8547 1 Dynamic 1 00402647F56F 1 Dynamic
Function:
Message:
Esc= Previous screen CTRL+R= Refresh CTRL+N= Next Page CTRL+P=Previous Page

Figure 6-44. Browse Address Table screen

The **Browse By** field can be toggled between *ALL*, *MAC Address*, *Port*, and *VLAN*. This sets a filter to determine which MAC addresses from the forwarding table are displayed. *ALL* specifies no filter.

To search for a particular MAC address:

Toggle the **Browse By>** field to **MAC Address**. A **MAC Address** field will appear. Enter the MAC address in the field and press **Enter**. Highlight BROWSE and press **Enter** to initiate the browsing action. Highlight CLEAR ALL and press **Enter** to reset the table counters.

Switch History

To view the switch history log, highlight **Switch History** from the **Network Monitoring Menu** and press **Enter**:

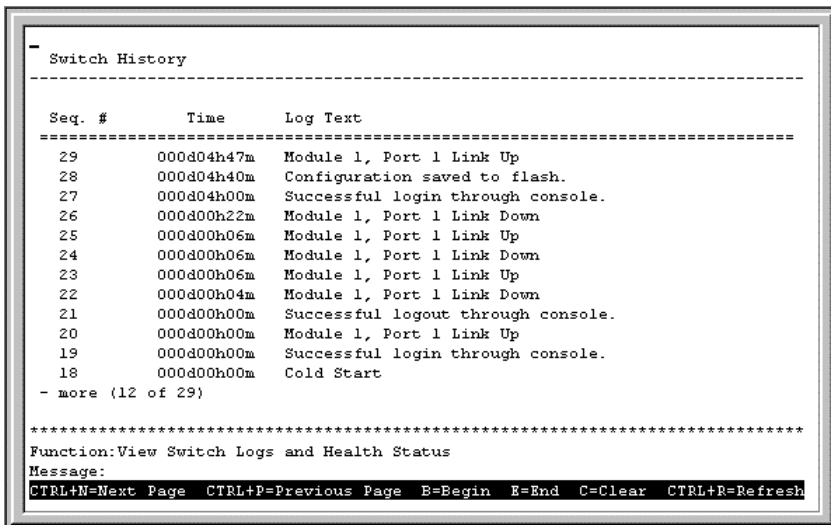

Switch History
Seq. # Time Log Text
29 000d04h47m Module 1, Port 1 Link Up
28 000d04h40m Configuration saved to flash.
27 000d04h00m Successful login through console.
26 000d00h22m Module 1, Port 1 Link Down
25 000d00h06m Module 1, Port 1 Link Up
24 000d00h06m Module 1, Port 1 Link Down
23 000d00h06m Module 1, Port 1 Link Up
22 000d00h04m Module 1, Port 1 Link Down
21 000d00h00m Successful logout through console.
20 000d00h00m Module 1, Port 1 Link Up
19 000d00h00m Successful login through console.
18 000d00h00m Cold Start
- more (12 of 29)
Function:View Switch Logs and Health Status
Message:
CTRL+N=Next Page CTRL+P=Previous Page B=Begin E=End C=Clear CTRL+R=Refresh

Figure 6-45. Switch History screen

IGMP Snooping

This allows the Switch's IGMP Snooping table to be viewed. IGMP Snooping allows the Switch to read the Multicast Group IP address and the corresponding MAC address from IGMP packets that pass through the Switch. The ports where the IGMP packets were snooped are displayed, signified with an *M*. The number of IGMP reports that were snooped are also displayed in the **Reports** field.

To view the IGMP Snooping table, highlight **IGMP Snooping** on the **Network Monitoring Menu** and press **Enter**.

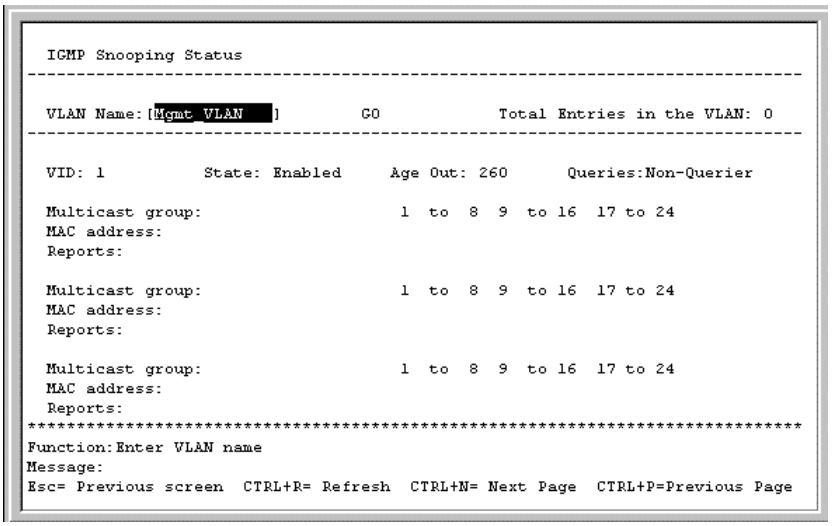

IGMP Snooping Status
VLAN Name: [Mgmt_VLAN] GO Total Entries in the VLAN: 0
VID: 1 State: Enabled Age Out: 260 Queries:Non-Querier
Multicast group: 1 to 8 9 to 16 17 to 24
MAC address:
Reports:
Multicast group: 1 to 8 9 to 16 17 to 24
MAC address:
Reports:
Multicast group: 1 to 8 9 to 16 17 to 24
MAC address:
Reports:
Function: Enter VLAN name
Message:
Esc= Previous screen CTRL+R= Refresh CTRL+N= Next Page CTRL+P=Previous Page

Figure 6-46. IGMP Snooping Status screen

Browse Multicast Status

To view the multicast address status table, highlight **Browse Multicast Status** on the **Network Monitoring Menu** and press **Enter**.

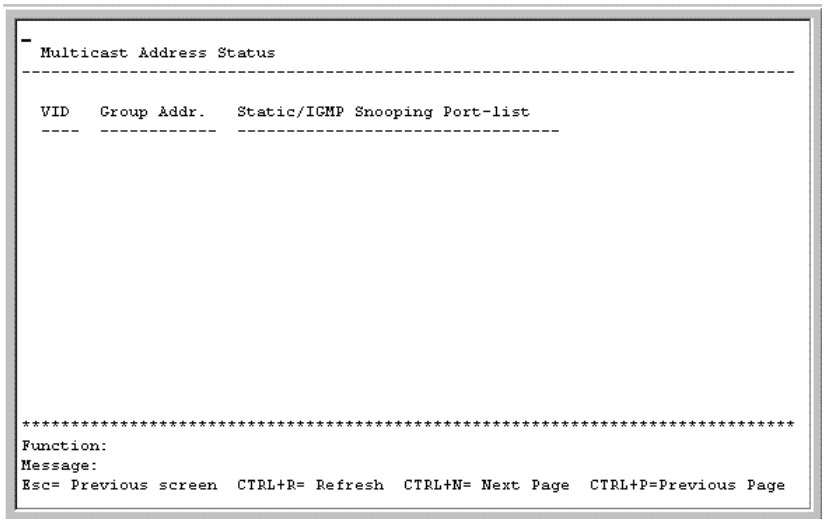

Multicast Address Status
VID Group Addr. Static/IGMP Snooping Port-list
Function:
Message:
Esc= Previous screen CTRL+R= Refresh CTRL+N= Next Page CTRL+P=Previous Page

Figure 6-47. Multicast Address Status screen

VLAN Status

This allows the status for each of the Switch's VLANs to be viewed.

To view the **VLAN Status** table, highlight **VLAN Status** on the **Network Monitoring Menu** and press **Enter**.

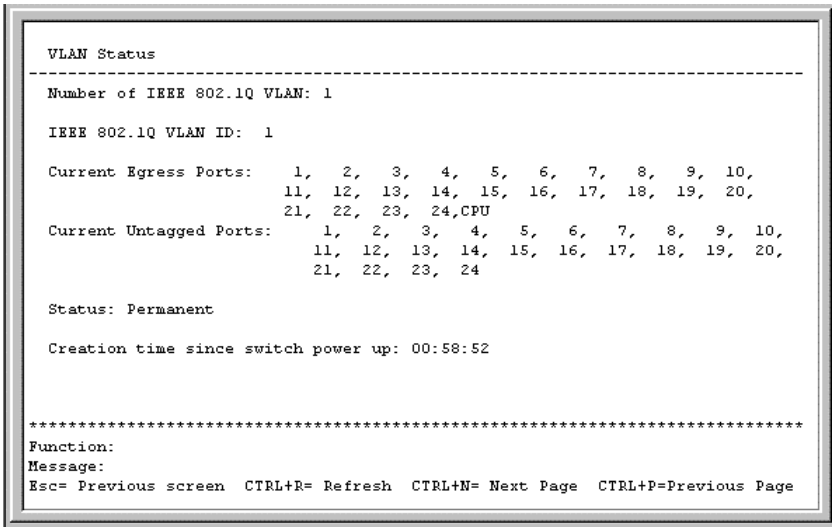

VLAN Status
Number of IEEE 802.1Q VLAN: 1
IEEE 802.1Q VLAN ID: 1
Current Egress Ports: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12, 13, 14, 15, 16, 17, 18, 19, 20,
21, 22, 23, 24,CPU
Current Untagged Ports: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12, 13, 14, 15, 16, 17, 18, 19, 20,
21, 22, 23, 24
Status: Permanent
Creation time since switch power up: 00:58:52
Function:
Message:
Esc= Previous screen CTRL+R= Refresh CTRL+N= Next Page CTRL+P=Previous Page

Figure 6-48. VLAN Status screen

SNMP Manager Configuration

The Switch sends out SNMP *traps* to network management stations whenever certain exceptional events occur, such as when the Switch is turned on or when a system reset occurs. The Switch allows traps to be routed to up to four different network management hosts.

For a detailed list of Trap Types used for this Switch, see the *Traps* section of Chapter 5, "*Switch Management and Operating Concepts.*"

SNMP (version 1) implements a rudimentary form of security by requiring that each request includes a *community name*. A community name is an arbitrary string of characters used as a "password" to control access to the Switch. If the Switch receives a request with a community name it does not recognize, it will trigger an authentication trap.

The SNMP allows up to four different community names to be defined. The community name **public** is defined by default; you can change this name in addition to adding others. You will need to coordinate these names with the community name settings you use in your network management system.

Choose **SNMP Manager Configuration** to access the third item on the main menu. The following screen appears:

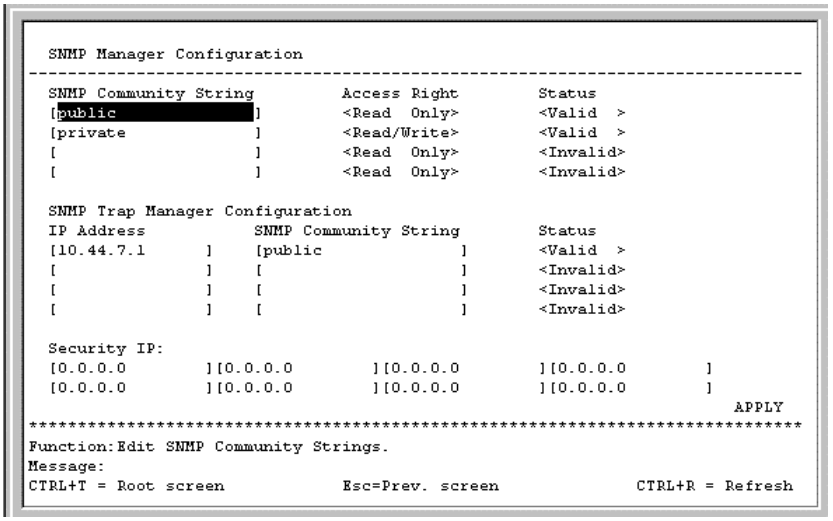


Figure 6-49. SNMP Manager Configuration screen

The following SNMP Manager and Trap Manager Configuration parameters can be set:

- **SNMP Community String –** The community string that will be included on SNMP packets sent to and from the switch. Any station not privy to this community will not receive the packet.
- **Access Right –** Allows each community to be separately set to either *Read Only*, meaning that the community member can only view switch settings or *Read / Write*, which allows the member to change settings in the switch.
- **Status –** Determines whether this community name entry is *Valid* or *Invalid*. An entry can be disabled by changing its status to *Invalid*.
- **IP Address –** The IP address of the network management station to receive traps.

The Security IP section allows you to create a list of IP addresses that are allowed to access the Switch via SNMP or Telnet.

Highlight APPLY and press **Enter** to allow your changes to take effect.

System Utilities

To access the **Switch Utilities** menu, highlight **System Utilities** on the main menu and press **Enter.**

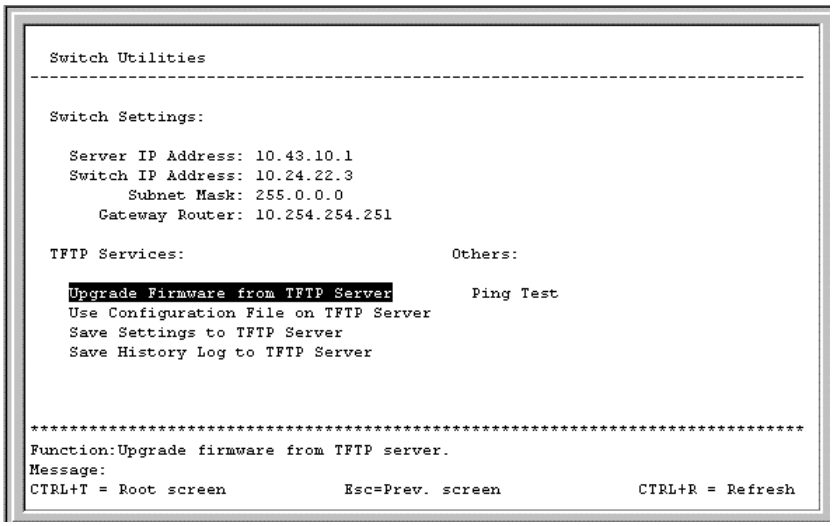


Figure 6-50. Switch Utilities menu

Note: *Trivial File Transfer Protocol (TFTP) services allow the switch firmware to be upgraded by transferring a new firmware file from a TFTP server to the Switch. A configuration file can also be loaded into the Switch from a TFTP server, switch settings can be saved to the TFTP server, and a history log can be uploaded from the Switch to the TFTP server.*

Upgrade Firmware from TFTP Server

To update the Switch's firmware, highlight **Upgrade Firmware from TFTP Server** and press **Enter**.

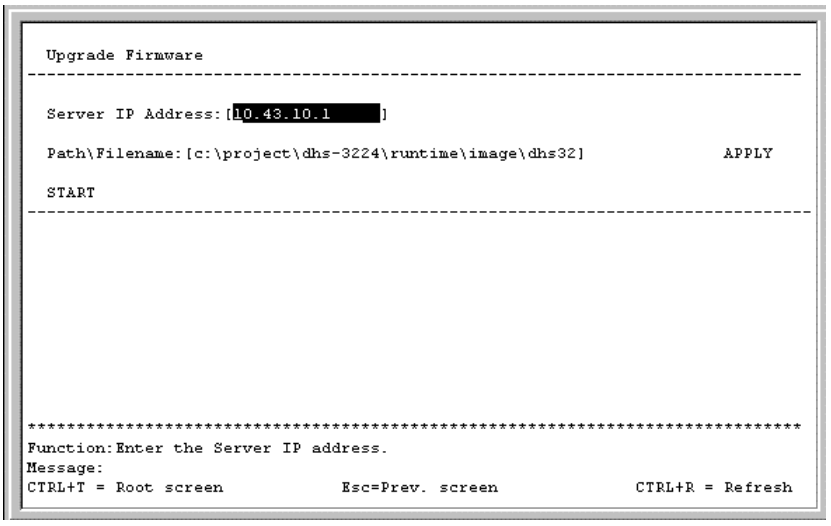


Figure 6-51. Upgrade Firmware screen

Enter the IP address of the TFTP server in the **Server IP Address:[ ]** field.

Note: *The TFTP server must be on the same IP subnet as the Switch.*

Enter the path and the filename to the firmware file on the TFTP server.

Note: *The TFTP server must be running TFTP server software to perform the file transfer. TFTP server software is a part of many network management software packages, or can be obtained as a separate program.*

Highlight APPLY and press **Enter** to record the IP address of the TFTP server. Use **Save Changes** from the main menu to enter the address into NV-RAM

Highlight START and press **Enter** to initiate the file transfer.

Use Configuration File on TFTP Server

To download a switch configuration file from a TFTP server, highlight **Use a Configuration File on TFTP Server** and press **Enter**.

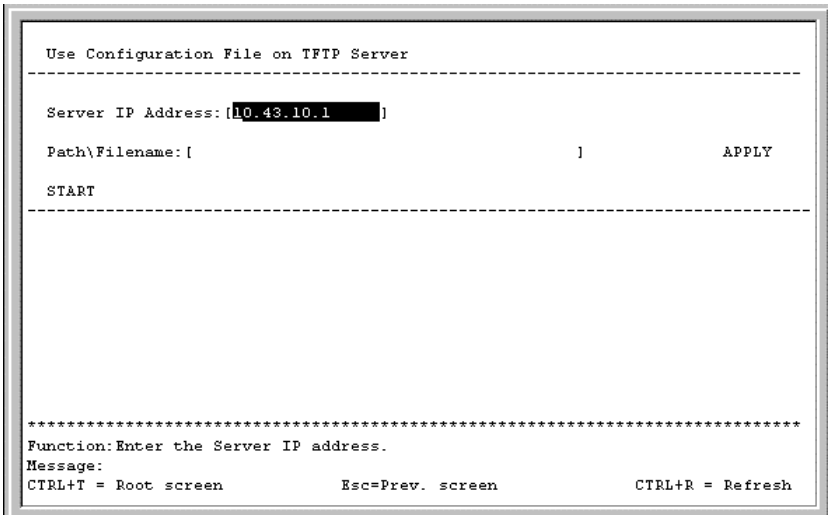


Figure 6-52. Use Configuration File on TFTP Server screen

Enter the IP address of the TFTP server and specify the location of the switch configuration file on the TFTP server.

Highlight APPLY and press **Enter** to record the IP address of the TFTP server. Use **Save Changes** from the main menu to enter the address into NV-RAM

Highlight START and press **Enter** to initiate the file transfer.

Save Settings to TFTP Server

To upload a settings file to the TFTP server, highlight **Save Settings to TFTP Server** and press **Enter.**

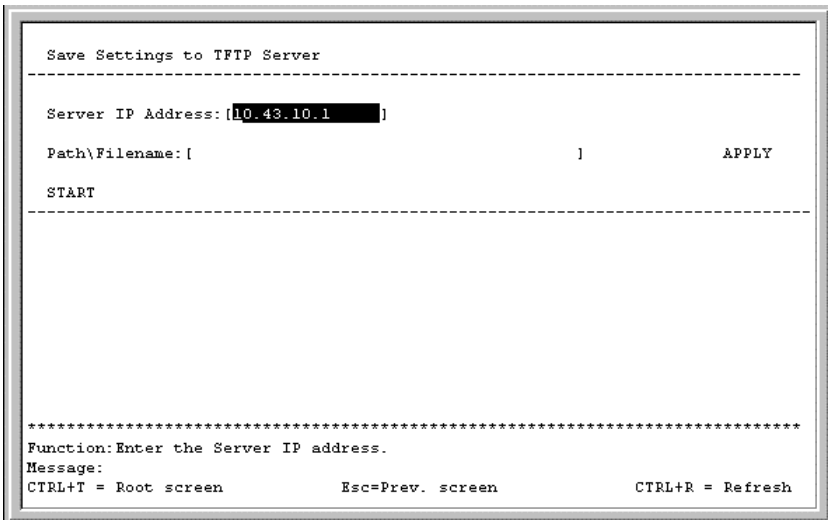


Figure 6-53. Save Settings to TFTP Server screen

Enter the IP address of the TFTP server and the path and filename of the settings file on the TFTP server and press APPLY. Highlight START and press **Enter** to initiate the file transfer.

Save History Log to TFTP Server

To save a History Log on a TFTP server, highlight **Save History Log to TFTP Server** and press **Enter.**

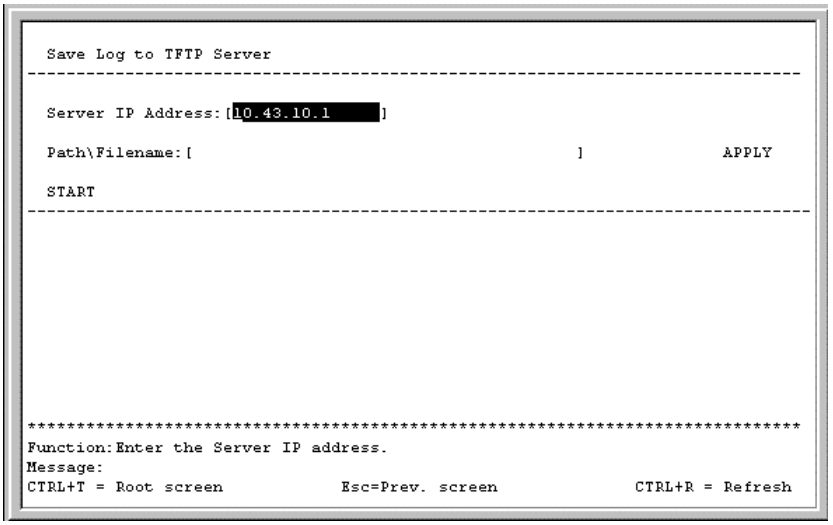


Figure 6-54. Save Log to TFTP Server screen

Enter the IP address of the TFTP server and the path and filename for the history log on the TFTP server. Highlight APPLY and press **Enter** to make the changes current. Highlight START and press **Enter** to initiate the file transfer.

Ping Test

To test the connection with another network device using Ping, highlight **Ping Test** and press **Enter**.

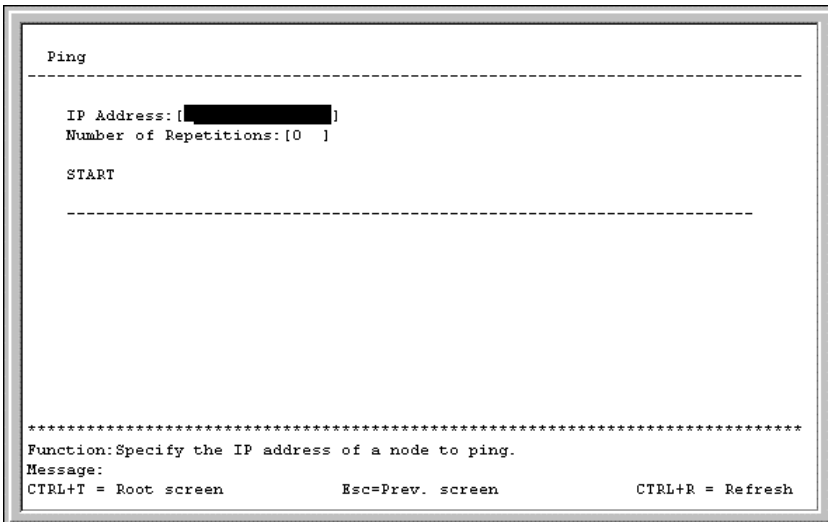


Figure 6-55. Ping screen

Enter the IP address of the network device to be Pinged and the number of test packets to be sent (3 is usually enough). Highlight START and press **Enter** to initiate the Ping program.

Reboot

The DES-3226 has several reboot options.

To reboot the Switch from the console, highlight **Reboot** from the main menu and press **Enter**.

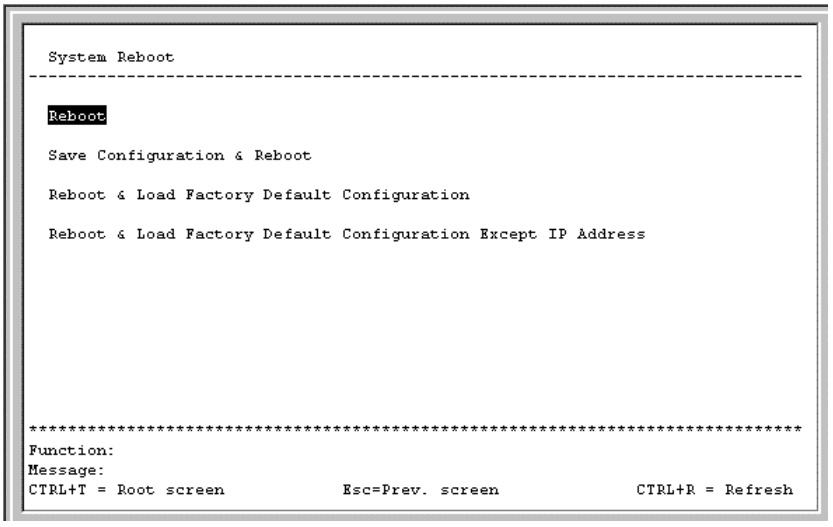


Figure 6-56. System Reboot menu

The reboot options are as follows:

- **Reboot –** Simply restarts the Switch. Any configuration settings not saved using **Save Changes** from the main menu will be lost. The Switch's configuration will be restored to the last configuration saved in NV-RAM.
- **Save Configuration & Reboot –** Saves the configuration to NV-RAM (identical to using **Save Changes**) and then restarts the Switch.

- **Reboot & Load Factory Default Configuration –** Restarts the Switch using the default factory configuration. All configuration data will be lost. This is identical to using **Factory Reset** and then **Reboot**.
- **Reboot & Load Factory Default Configuration Except IP Address –** Restarts the Switch using the default factory configuration, except the user configured IP address will be retained. All other configuration data will be lost.

A confirmation screen will appear:

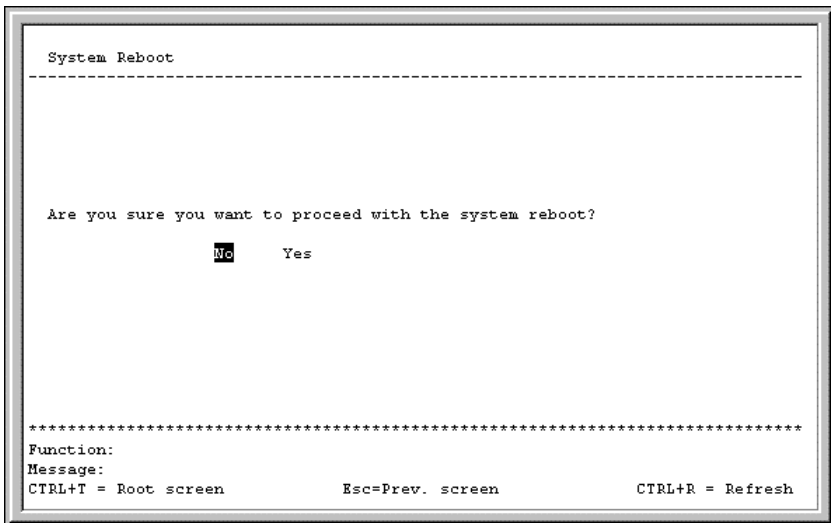


Figure 6-57. System Reboot confirmation screen

To reboot the Switch, in the mode entered above, highlight Yes and press **Enter.**

7

WEB-BASED NETWORK MANAGEMENT

Introduction

The DES-3226 offers an embedded Web-based (HTML) interface allowing users to manage the Switch from anywhere on the network through a standard browser, such as Netscape Navigator/Communicator or Microsoft Internet Explorer. The Web browser acts as a universal access tool and can communicate directly with the Switch using the HTTP protocol. Your browser window may vary with the screen shots (pictures) in this guide.

The Web-based management module and the Console program (and Telnet) are different ways to access the same internal switching software and configure it. Thus, all settings encountered in Web-based management are the same as those found in the console program.

Note: This Web-based Management Module does not accept Chinese language input (or other languages requiring 2 bytes per character).

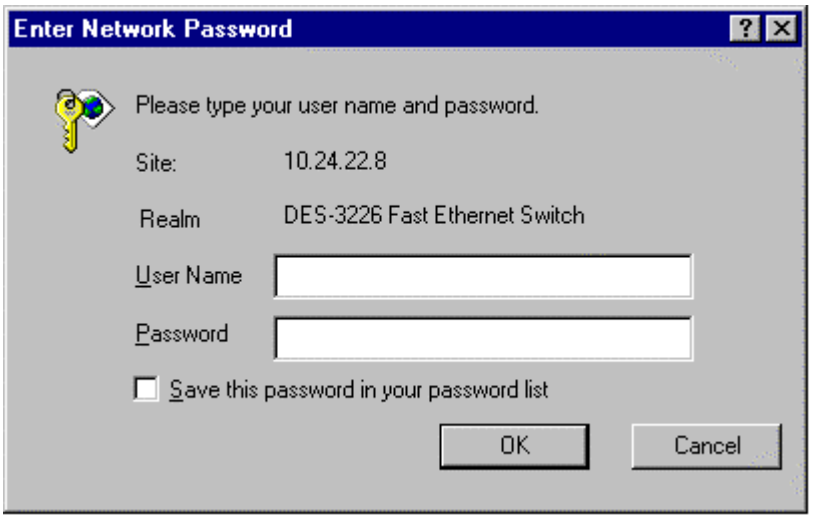
Getting Started

The first step in getting started in using Web-based management for your Switch is to secure a browser. A Web browser is a program that allows a person to read hypertext, for example, Netscape Navigator or Microsoft Internet Explorer. Follow the installation instructions for the browser.

The second and last step is to configure the IP interface of the Switch. This should be done manually through a console (see the *Configure IP Address* section in the "*Using The Console Interface*" chapter).

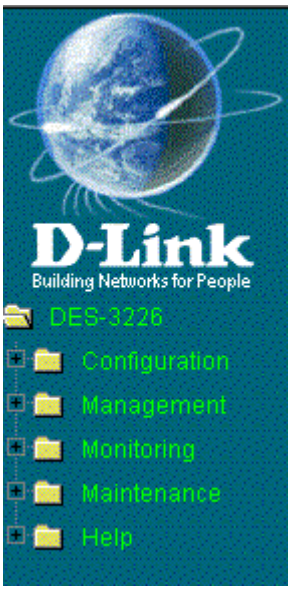
You are now ready to begin managing your Switch by simply running the browser installed on your computer and pointing it to the IP address you have defined for the device. The URL in the address bar should read something like: http://123.123.123.123, where the numbers 123 represent the IP address of the switch. Please note that the proxy for session connection should be turned off.

The following dialog box will open:



Click **OK** as there is no preset user name or password on the Switch. This opens the main page in the management module.

The panel on the left-hand side contains the main menu. The featured items include: **Configuration**, **Management**, **Monitoring**, **Maintenance**, and **Help**.



These are the major categories for Switch management. Clicking on the small square hyperlink to the left of the folder icons will cause a list of additional sub-menus to appear directly below each of the first four main menu categories.

The switch management features available in the Web-based are explained below.

Configuration

The first category includes: **IP Address**, **Switch Information**, **Advanced Settings**, **Port Configuration**, **Port Mirroring**, **Port Trunking**, **IGMP Settings**, **Spanning Tree**, **Static Filtering Table**, **VLANs**, **Port Bandwidth**, **Threshold of Broadcast**, **Port Priority**, **Class of Traffic**, **Class of Service**, and **Port Security**, as well secondary screens.

IP Address

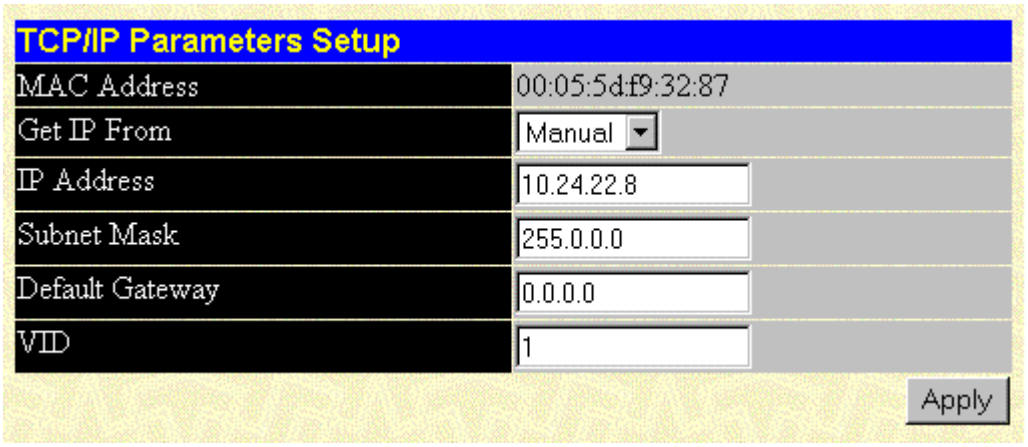


Figure 7-1. TCP/IP Parameters Setup window

This window is used to determine whether the Switch should get its IP Address settings from the user (*Manual*), a *BOOTP* server, or a *DHCP* server. If you are not using either BOOTP or DHCP, enter the **IP Address**, **Subnet Mask**, and **Default Gateway** of the Switch. If you enable BOOTP, you do not need to configure any IP parameters because a BOOTP server automatically assigns IP configuration parameters to the Switch. If you enable DHCP, a Dynamic Host Configuration Protocol request will be sent when the Switch is powered up. Once you have selected a setting under **Get IP From**, click **Apply** to activate the new settings.

The information is described as follows:

- **MAC Address –** The Ethernet address for the device. Also known as the physical address
- **Get IP From –** There are three choices for how the Switch receives its IP Address settings: *Manual*, *BOOTP*, and *DHCP*.
- **IP Address –** The host address for the device on the TCP/IP network.
- **Subnet Mask –** The address mask that controls subnetting on your TCP/IP network.
- **Default Gateway –** The IP address of the device, usually a router, that handles connections to other subnets and/or other TCP/IP networks.
- **VID –** The VLAN ID number.

Switch Information

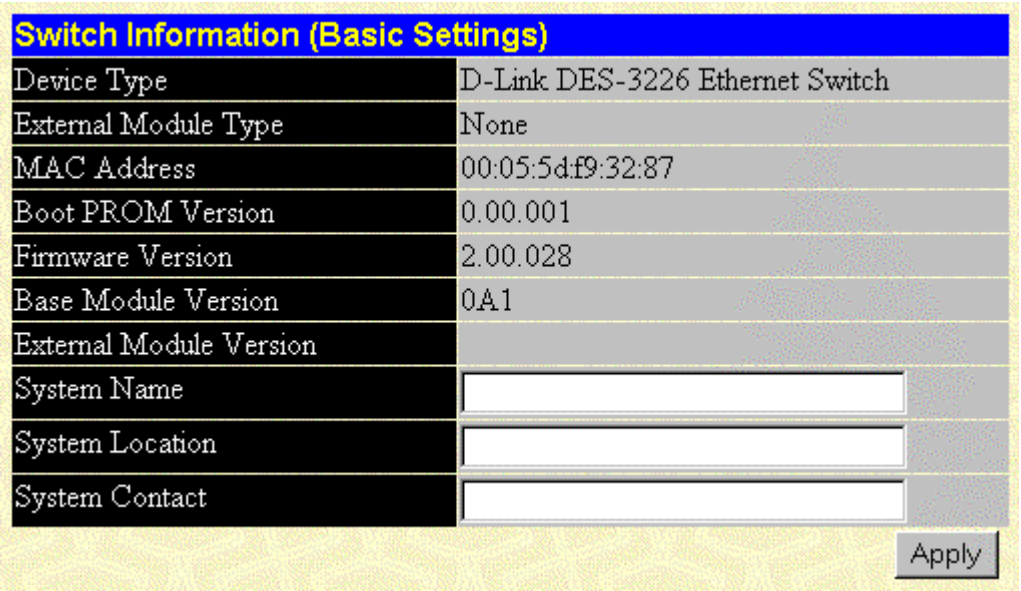


Figure 7-2. Switch Information (Basic Settings) window

To set basic switch settings, enter a **System Name** in the first field, the physical location of the Switch in the **System Location** field, and the name of the contact person responsible for the Switch in the **System Contact** field. Then click **Apply**.

The information is described as follows:

- **Device Type –** A description of the Switch type.
- **External Module Type –** Description of optional module plugged into front slot.
- **MAC Address –** The Ethernet address for the device.
- **Boot PROM Version –** Version number for the firmware chip. This information is needed for new runtime software downloads.
- **Firmware Version –** Version number of the firmware installed on the Switch. This can be updated by using the **Update Firmware** window in the **Reset and Update** section.
- **Base Module Version –** Version number of the base module.
- **External Module Version –** Version of optional module plugged into front slot.
- **System Name –** A user-assigned name for the Switch.
- **System Location –** A user-assigned description for the physical location of the Switch.
- **System Contact –** Name of the person to contact should there be any problems or questions with the system. You may also want to include a phone number or extension.

Advanced Settings

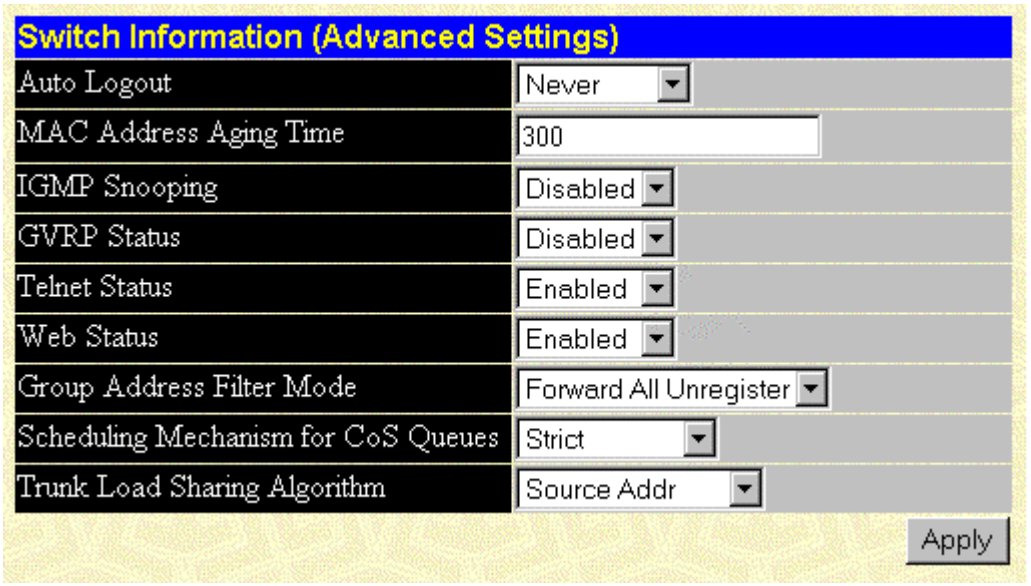


Figure 7-3. Switch Information (Advanced Settings) window

After making the desired advanced setting Layer 2 changes, click **Apply** to let them take effect.

The information in the window is described as follows:

- **Auto-Logout [***2 Minutes***]–** This sets the time the interface can be idle before the Switch automatically logs-out the user. The options are *2 minutes*, *5 minutes*, *10 minutes*, *15 minutes*, or *Never*.

- **MAC Address Aging Time [***300* **] –** This field specifies the length of time a learned MAC Address will remain in the forwarding table without being accessed (that is, how long a learned MAC Address is allowed to remain idle). The Aging Time can be set to any value between 10 and 1,000,000 seconds.

  Note: *A very long Aging Time can result with the out-of-date Dynamic Entries that may cause incorrect packet filtering/forwarding decisions. A very short aging time may cause entries to be aged out to soon, resulting in a high percentage of received packets whose source addresses cannot be found in the address table, in which case the Switch will broadcast the packet to all ports, negating many of the benefits of having a Switch.*

- **IGMP Snooping [***Disabled***] –** This setting enables Internet Group Management Protocol (IGMP) Snooping, which enables the Switch to read IGMP packets being forwarded through the Switch in order to obtain forwarding information from them (learn which ports contain Multicast members.

- **GVRP Status [***Enabled***] –** Group VLAN Registration Protocol is a protocol that allows members to dynamically join VLANs. This is used to enable or disable GVRP on the Switch

- **Telnet Status [***Enabled***] –** Toggle to *Enabled* to allow access to the Switch over the network using the TCP/IP Telnet protocol.

- **Web Status [***Enabled***] –** You can also use a Web-based browser to manage the Switch by toggling to *Enabled*.

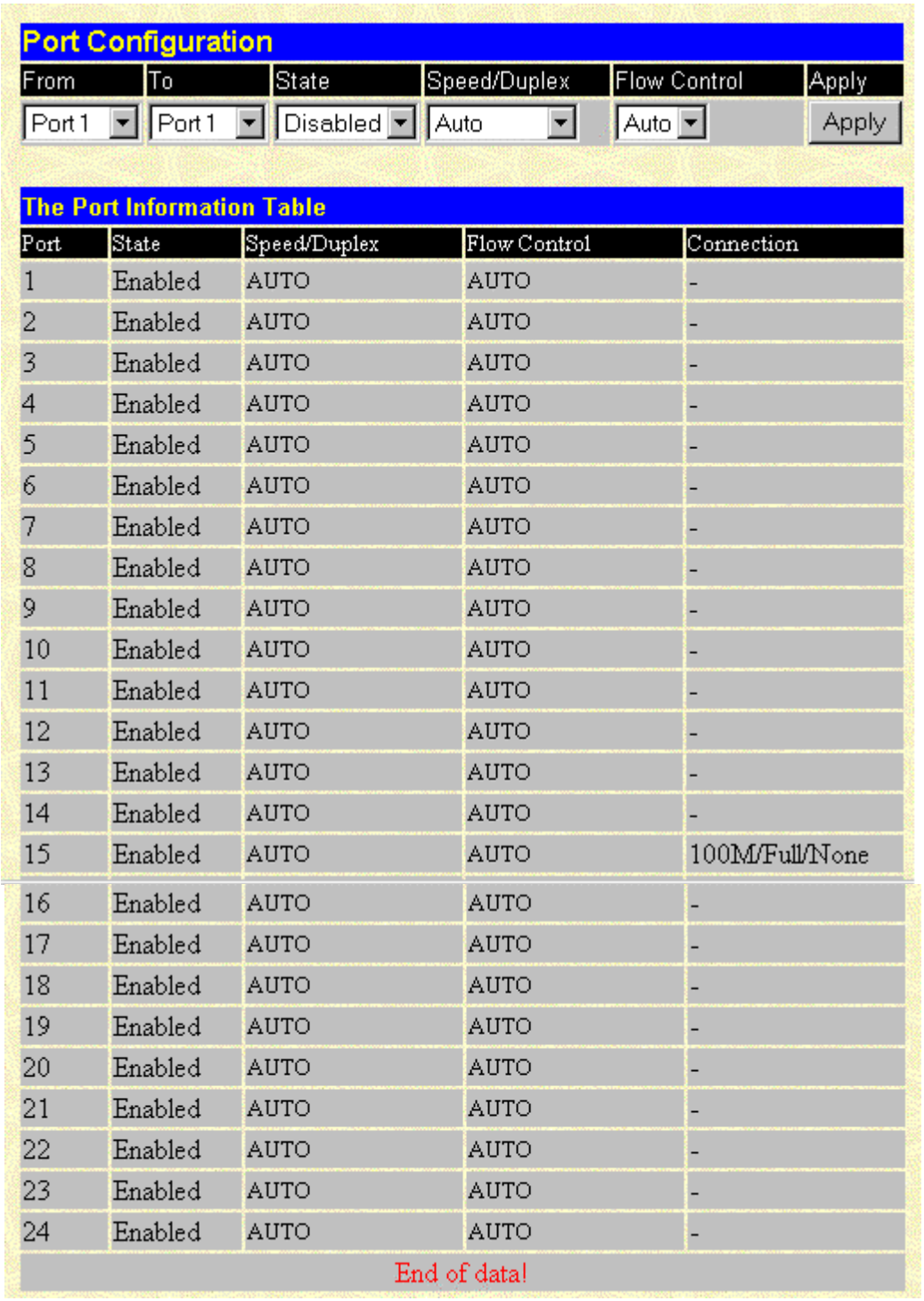
- **Group Address Filter Mode [***Forward All Unregister***] –** The IGMP filter mode for processing multicast packets. The options are *Forward All*, *Forward All Unregister*, and *Filtered All Unregister*.

- **Scheduling Mechanism for CoS Queues [***Strict***] –** There are two Class of Service queue options, *RoundRobin* and *Strict*. If *Strict* is selected, when the highest priority queue is full, those packets will be the first to

be forwarded. If *RoundRobin* is selected, the forwarding is based on the settings made on the **Class of Service Configuration** screen.

- **Trunk Load Sharing Algorithm [***Src Address***] –** The trunk load sharing options are *Dst Address*, *Src&Dst Address*, and *Src Address*.

Port Configuration



Port Configuration

From	To	State	Speed/Duplex	Flow Control	Apply
Port 1	Port 1	Disabled	Auto	Auto	Apply

The Port Information Table

Port	State	Speed/Duplex	Flow Control	Connection
1	Enabled	AUTO	AUTO	-
2	Enabled	AUTO	AUTO	-
3	Enabled	AUTO	AUTO	-
4	Enabled	AUTO	AUTO	-
5	Enabled	AUTO	AUTO	-
6	Enabled	AUTO	AUTO	-
7	Enabled	AUTO	AUTO	-
8	Enabled	AUTO	AUTO	-
9	Enabled	AUTO	AUTO	-
10	Enabled	AUTO	AUTO	-
11	Enabled	AUTO	AUTO	-
12	Enabled	AUTO	AUTO	-
13	Enabled	AUTO	AUTO	-
14	Enabled	AUTO	AUTO	-
15	Enabled	AUTO	AUTO	100M/Full/None
16	Enabled	AUTO	AUTO	-
17	Enabled	AUTO	AUTO	-
18	Enabled	AUTO	AUTO	-
19	Enabled	AUTO	AUTO	-
20	Enabled	AUTO	AUTO	-
21	Enabled	AUTO	AUTO	-
22	Enabled	AUTO	AUTO	-
23	Enabled	AUTO	AUTO	-
24	Enabled	AUTO	AUTO	-

End of data!

Figure 7-4. Port Configuration window

Select the port you want to configure by using the drop-down menus in the **From** and **To** fields or click on the port in the Switch front panel display at the top of the window. Follow these steps:

1. Enable or disable the port. If you choose *Disabled* in the **State** field, devices connected to that port cannot use the Switch, and the Switch purges their addresses from its address table after the MAC address aging time elapses.

2. Configure the **Speed/Duplex** setting for the port. Select *Auto* to allow the port to select the best transmission speed, duplex mode and flow control settings based on the capabilities of the device at the other end. The other selections allow you to force the port to operate in the specified manner. Select *100M/FULL* for port operation at 100 Mbps and full duplex. Select *100M/HALF* for port operation at 100 Mbps and half duplex. Select *10M/FULL* for port operation at 10 Mbps and full duplex. Select *10M/HALF* for port operation at 10 Mbps and half duplex.

3. Configure the **Flow Control** setting for the port. Selecting *Enabled* in full-duplex mode will implement IEEE 802.3x flow control. Select *Disabled* for no flow control. Also, if the port is set for *Auto* (NWay) in the speed/duplex field above and flow control is enabled, flow control (whether full- or half-duplex) will only be implemented if the other device can auto-negotiate flow control. Note that you must reboot the Switch before a flow control change can take effect.

4. Click **Apply** to let your changes take effect.

Port Mirroring

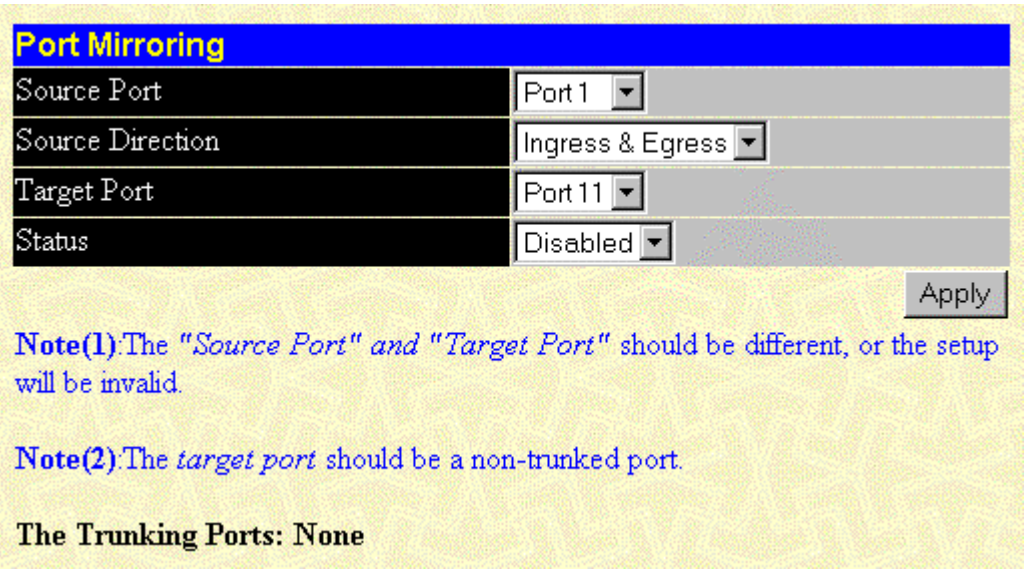


Figure 7-5. Port Mirroring window

The Switch allows you to copy frames transmitted and received on a port and redirect the copies to another port. You can attach a monitoring device to the mirrored port, such as a sniffer or an RMON probe, to view details about the packets passing through the first port.

To configure a mirror port, first select the **Source Port** from where you want to copy frames and the **Target Port**, which receives the copies from the source port. This is the port where you will connect a monitoring/troubleshooting device such as a sniffer or an RMON probe. Next, select the **Source Direction**, *Ingress*, *Egress*, or *Ingress& Egress* , and *Enabled* from the **Status** pull-down menu. Finally, click **Apply** to let the changes take effect.

Note: You cannot mirror a fast port onto a slower port. For example, if you try to mirror the traffic from a 100 Mbps port onto a 10 Mbps port, this can cause throughput problems. The port you are copying frames from should always support an equal or lower speed than the port to which you are sending the copies. Also, the target

port for the mirroring cannot be a member of a trunk group. Please note a target port and a source port can not be the same port.

Port Trunking

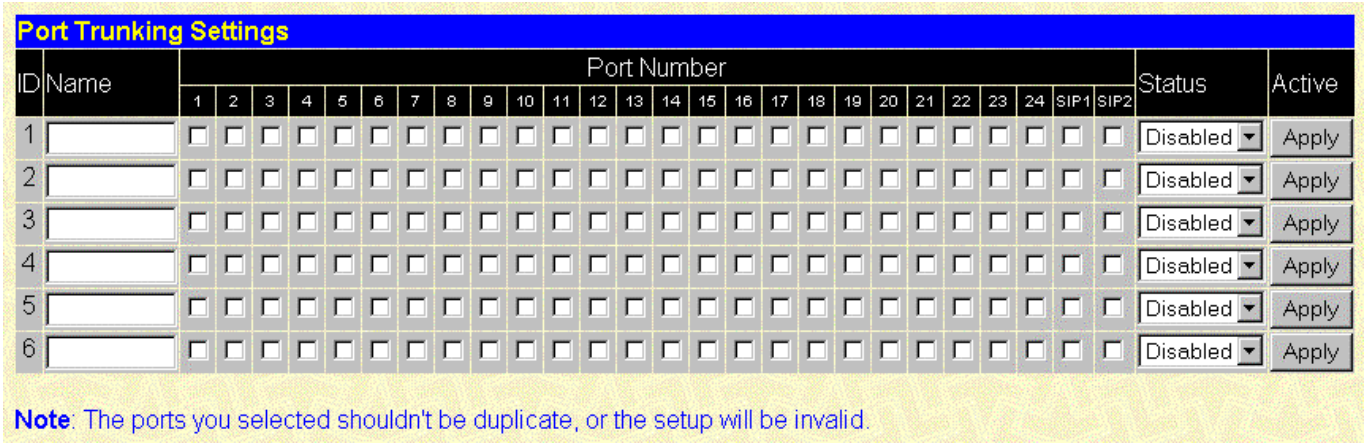


Figure 7-6. Port Trunking Settings window

The Switch supports up to 6 trunk groups. Trunks are groups of ports that are banded together to form a single, logical, high-bandwidth data pipe.

To create or modify a trunk group, enter a name in the first field, check the ports that will compose the port trunk, and change the **Status** field to *Enabled*. Click **Apply** to let your changes take effect.

Items in the above window are defined as follows:

- **Name** The user-assigned name of the trunk group.
- **Port Numbers** Check the number of ports that will be members of the trunk group.
- **Status** Enables or disables the trunk group.

IGMP Settings

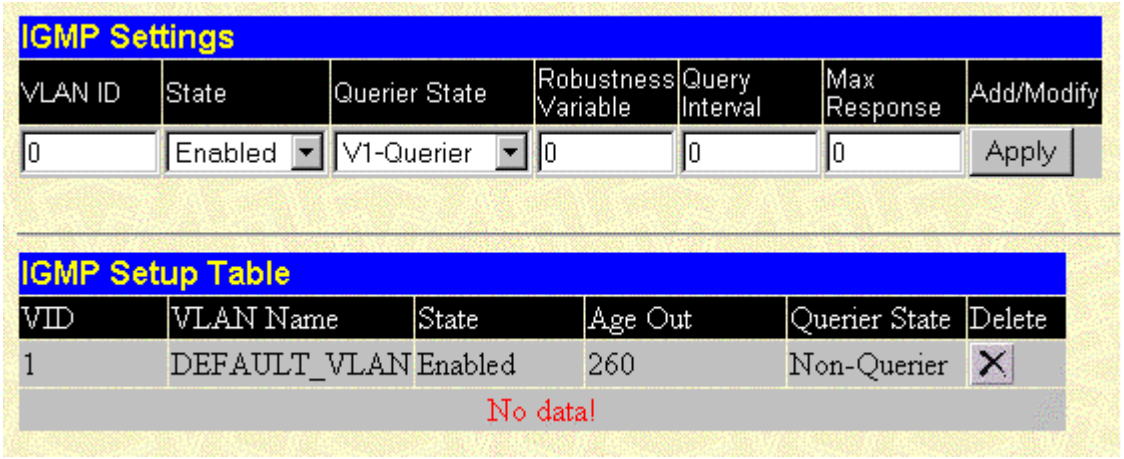


Figure 7-7. IGMP Settings window

Internet Group Management Protocol (IGMP) snooping allows the Switch to recognize IGMP queries and reports sent between network stations or devices and an IGMP host. When enabled for IGMP snooping, the Switch can open or close a port to a specific device based on IGMP messages passing through the Switch.

To set up IGMP snooping, enter a VLAN ID number in the first field and change the **State** field to *Enabled*. Next, select the desired setting in the **Querier State** field—this determines the version of IGMP that is used in your network—and enter values in the following three fields. A value between 1 and 255 can be entered for the **Robustness Variable** (default is 2). The **Query Interval** can be set between 1 and 65500 seconds. This sets the time between IGMP queries. The **Max Response** allows a setting between 1 and 25 seconds and specifies the maximum amount of time allowed before sending a response report. Click **APPLY** to make the settings effective.

The user-changeable parameters in the Switch are as follows:

- **VLAN ID** – Enter a VLAN ID number in this field.
- **State** – Use the drop-down menu to enable or disable IGMP settings.
- **Querier State** – Select from *Non-Querier*, *V1-Querier*, and *V2-Querier*. This is used to specify the IGMP version (1 or 2) that will be used by the IGMP interface when making queries.
- **Robustness Variable** – A tuning variable to allow for sub-networks that are expected to lose a large number of packets. A value between 1 and 255 can be entered, with larger values being specified for sub-networks that are expected to lose larger numbers of packets.
- **Query Interval** – Allows the entry of a value between 1 and 65500 seconds, with a default of 125 seconds. This specifies the length of time between sending IGMP queries.
- **Max Response** – Sets the maximum amount of time allowed before sending an IGMP response report. A value between 1 and 25 seconds can be entered.
- **Add/Modify** – Click this hyperlink to add or modify an IGMP entry on this window.
- **Delete** – Click this hyperlink to delete an IGMP entry on this window.

Spanning Tree

This section includes two windows, **STP Switch Settings** and **STP Port Settings**.

STP Switch Settings

The Switch supports 801.2d Spanning Tree Protocol, which allows you to create alternative paths (with multiple switches or other types of bridges) in your network. See the Spanning Tree Algorithm section of the "*Switch Management and Operating Concepts*" chapter for a detailed explanation.

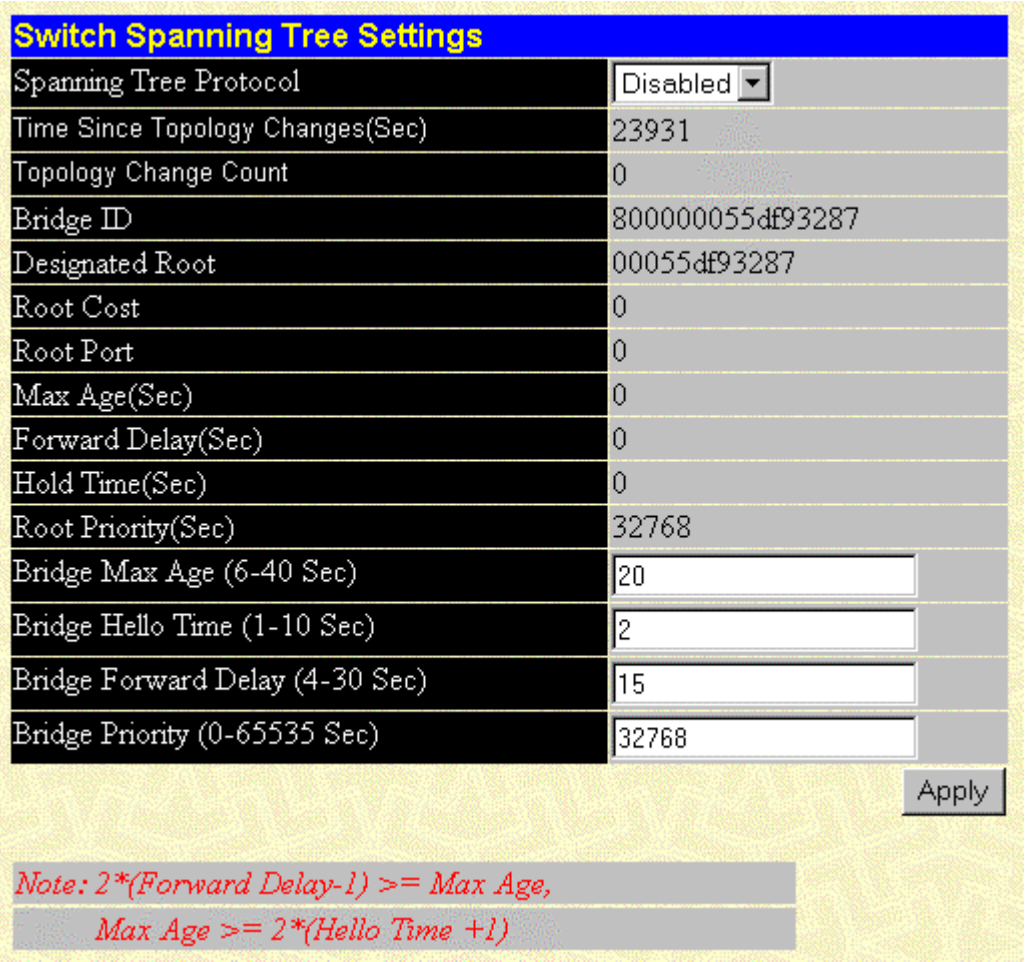


Figure 7-8. Switch Spanning Tree Settings window

Click **Apply** after making changes to the window above.

Parameters that you can change are:

- **Spanning Tree Protocol** – This drop-down menu allows you to enable the Spanning Tree Protocol setting.
- **Bridge Max Age (6-40 Sec)** – The Maximum Age can be from 6 to 40 seconds. At the end of the Maximum Age, if a BPDU has still not been received from the Root ridge, your Switch will start sending its own BPDU to all other switches for permission to become the Root Bridge. If it turns out that your Switch has the lowest Bridge Identifier, it will become the Root Bridge.
- **Bridge Hello Time (1-10 Sec)** – The Hello Time can be from 1 to 10 seconds. This is the interval between two transmissions of BPDU packets sent by the Root Bridge to tell all other switches that it is indeed the Root Bridge. If you set a Hello Time for your Switch, and it is not the Root Bridge, the set Hello Time will be used if and when your Switch becomes the Root Bridge.
- **Bridge Forward Delay (4-30 Sec)** – The Forward Delay can be from 4 to 30 seconds. This is the time any port on the Switch spends in the listening state while moving from the blocking state to the forwarding state.
- **Bridge Priority (0-65535 Sec)** – A Bridge Priority can be from 0 to 65535. Zero is equal to the highest Bridge Priority.

STP Port Settings

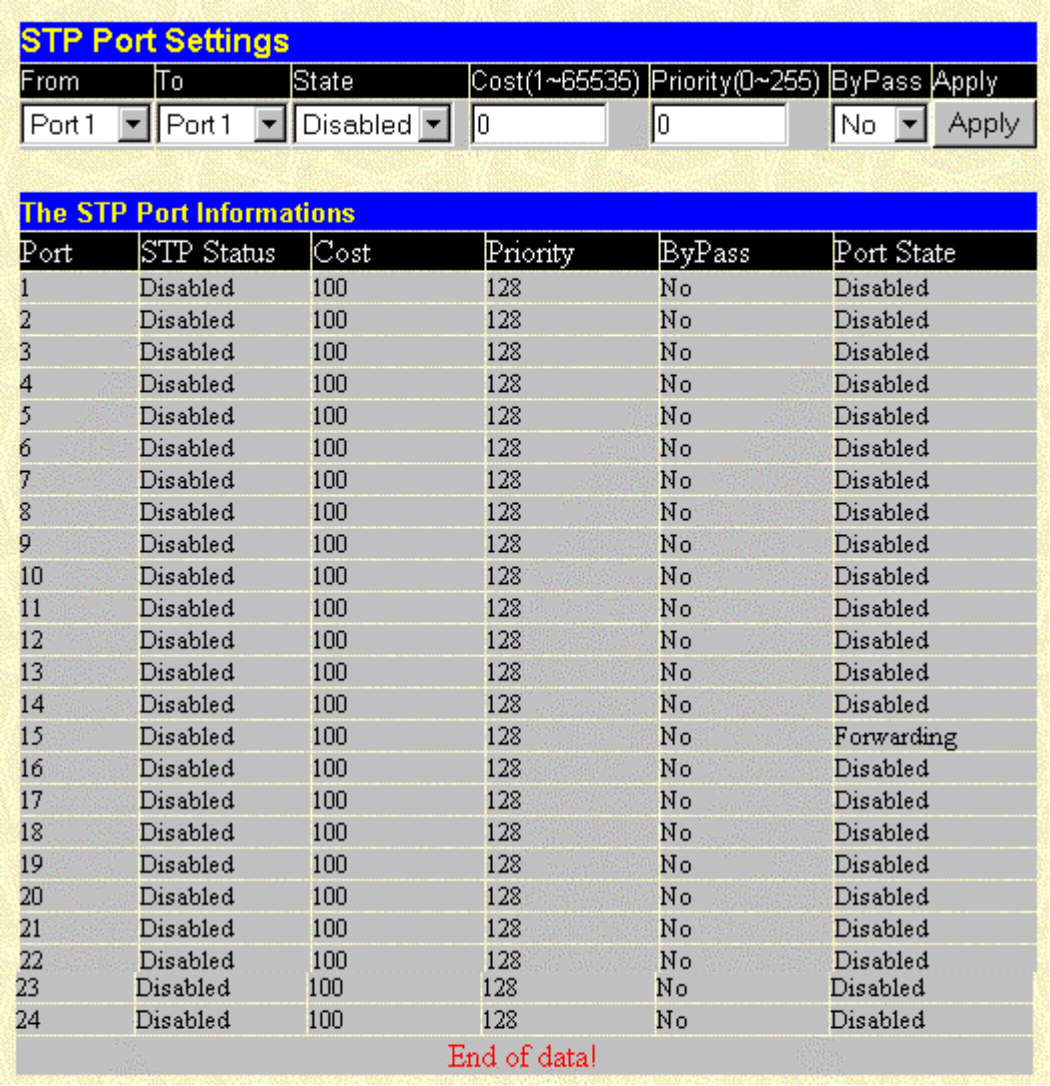


Figure 7-9. STP Port Settings window

To configure Spanning Tree Protocol functions for individual ports, enter the desired information in the fields on this window (see the descriptions below for assistance) and then click **Apply**.

The information on the window is described as follows:

- **From** – Enter the first port to be configured.
- **To** – Enter the last port to be configured.
- **State** – The Spanning Tree Protocol state for a selected port can either be *Enabled* or *Disabled*.
- **Cost (1~65535)** – A port cost can be set between 1 and 65535. The lower the cost, the greater the probability the port will be chosen as the designated port (chosen to forward packets).
- **Priority (0~255)** – A port priority can be set between 0 to 255. The lower the priority, the greater the probability the port will be chosen as the root port.
- **Bypass** – This sets the forward delay timer to zero thus bypassing the waiting time before the listening state.

Static Filtering Table

Unicast Filtering

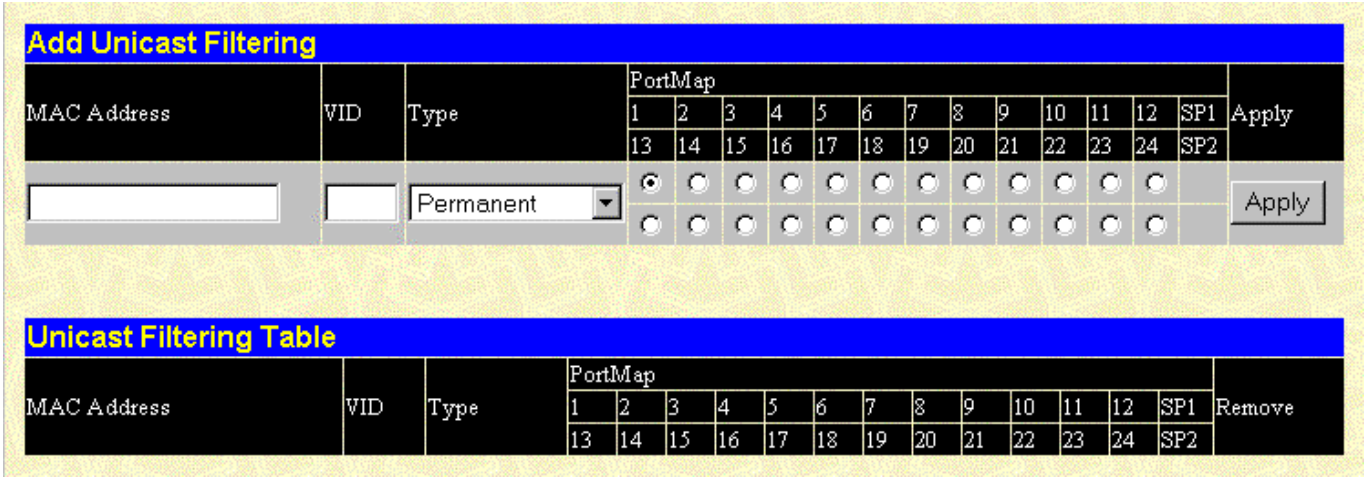

Add Unicast Filtering
MAC Address
VID
Type
PortMap
1 2 3 4 5 6 7 8 9 10 11 12 SP1
13 14 15 16 17 18 19 20 21 22 23 24 SP2
Apply
Permanent
Apply
Unicast Filtering Table
MAC Address
VID
Type
PortMap
1 2 3 4 5 6 7 8 9 10 11 12 SP1
13 14 15 16 17 18 19 20 21 22 23 24 SP2
Remove

Figure 7-10. Add Unicast Filtering window

The window above allows you to set up static packet filtering on the Switch.

The information on the window is described as follows:

- **MAC Address** – The MAC address from which packets will be statically filtered.
- **VID** – The VLAN ID number of the VLAN to which the MAC address belongs.
- **Type** – Select the filter type, *Permanent* or *DeleteOnReset*.
- **Port Map** – Allows the designation of the port on which the above MAC address resides.

Multicast Filtering

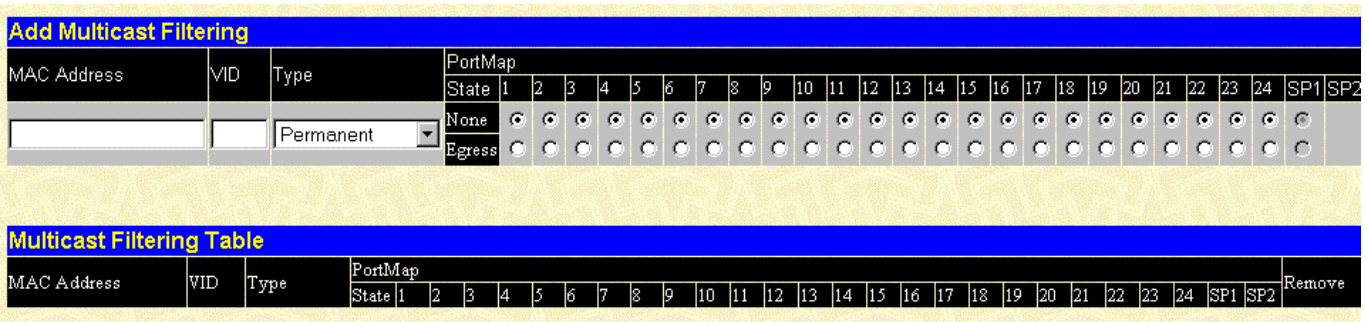

Add Multicast Filtering
MAC Address
VID
Type
PortMap
State 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 SP1 SP2
None
Egress
Permanent
Multicast Filtering Table
MAC Address
VID
Type
PortMap
State 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 SP1 SP2
Remove

Figure 7-11. Add Multicast Filtering window

The information on the window is described as follows:

- **MAC Address** – The MAC address of the static source of multicast packets.
- **VID** – The VLAN ID number of the VLAN to which the MAC address belongs.
- **Type** – Select the filter type, *Permanent* or *DeleteOnReset*.

- **Port Map** – Allows the selection of ports that will be a members of the static multicast group and ports that have no restrictions from joining dynamically.

VLANs

This section includes **Static VLAN Entry** and **Port VLAN ID (PVID)**.

Static VLAN Entry

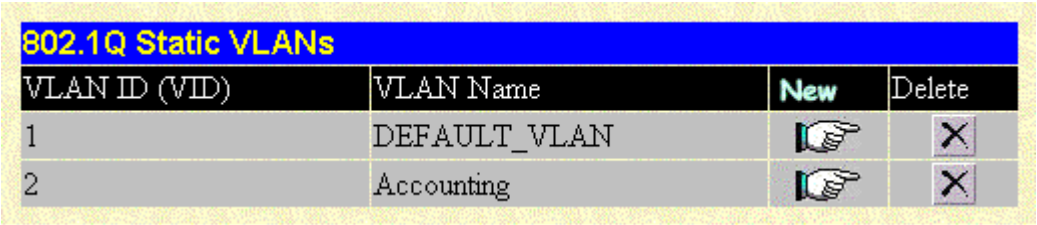


Figure 7-12. 802.1Q Static VLANs window

To add an entry to this table, click the **New** icon and then fill in the appropriate information in the window below. To delete an entry, click the icon in the Delete column.

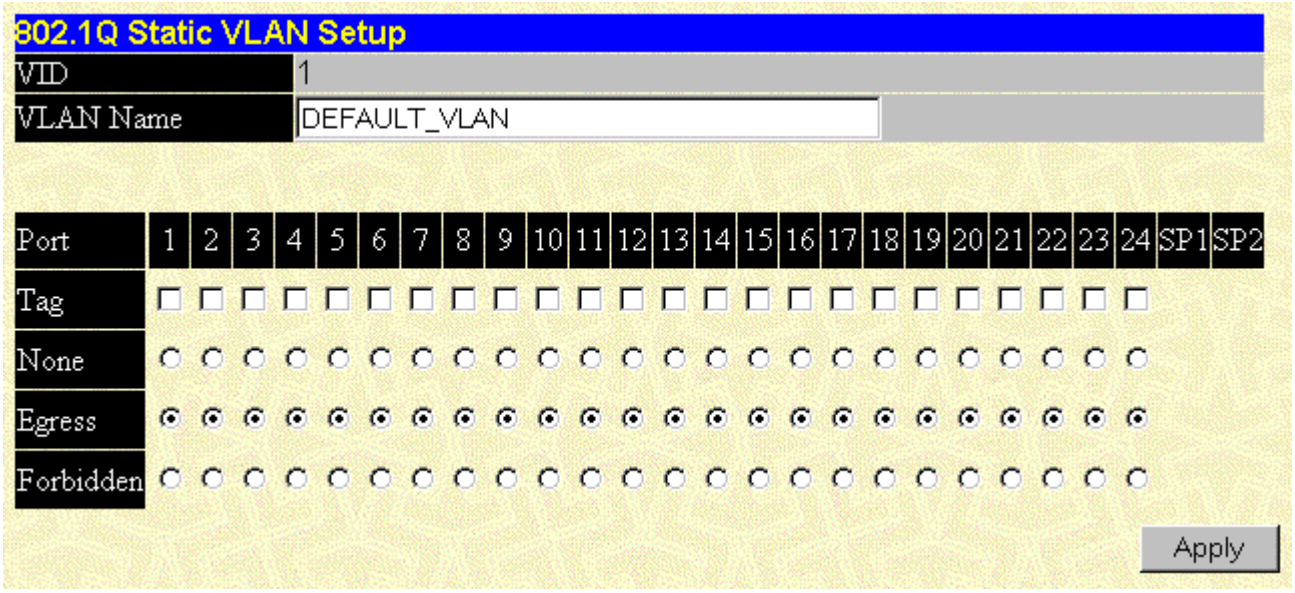


Figure 7-13. 802.1Q Static VLAN Setup window

To configure an 802.1Q static VLAN entry, select the desired VLAN ID number in the first field and then enter a VLAN name in the second field. Next, either check the Tag option, or leave it unchecked if you don't want a member port to be a *Tagging* port. In the last tow rows, None should be checked if you don't want a port to belong to the VLAN. Otherwise, check Egress to statically set a port to belong to a VLAN. Click **Apply** to let the changes take effect.

To modify an entry, complete the appropriate information on the window above and then click **Modify**.

To delete an entry, complete the appropriate information on the window above and then click **Delete**.

The information on the window is described as follows:

- **VLAN ID (VID)** – The VLAN ID of the VLAN that is being created.
- **VLAN Name** – The name of the VLAN that is being created.
- **Tag** – Specifies the port as either 802.1Q tagging or 802.1Q untagging. Checking the box will designate the port as Tagging.
- **None** – Specifies the port as not being a static member of the VLAN, but with no restrictions for joining the VLAN dynamically through GVRP.
- **Egress** – Specifies the port as being a static member of the VLAN. Egress Member Ports are ports that will be transmitting traffic for the VLAN.

Port VLAN ID (PVID)

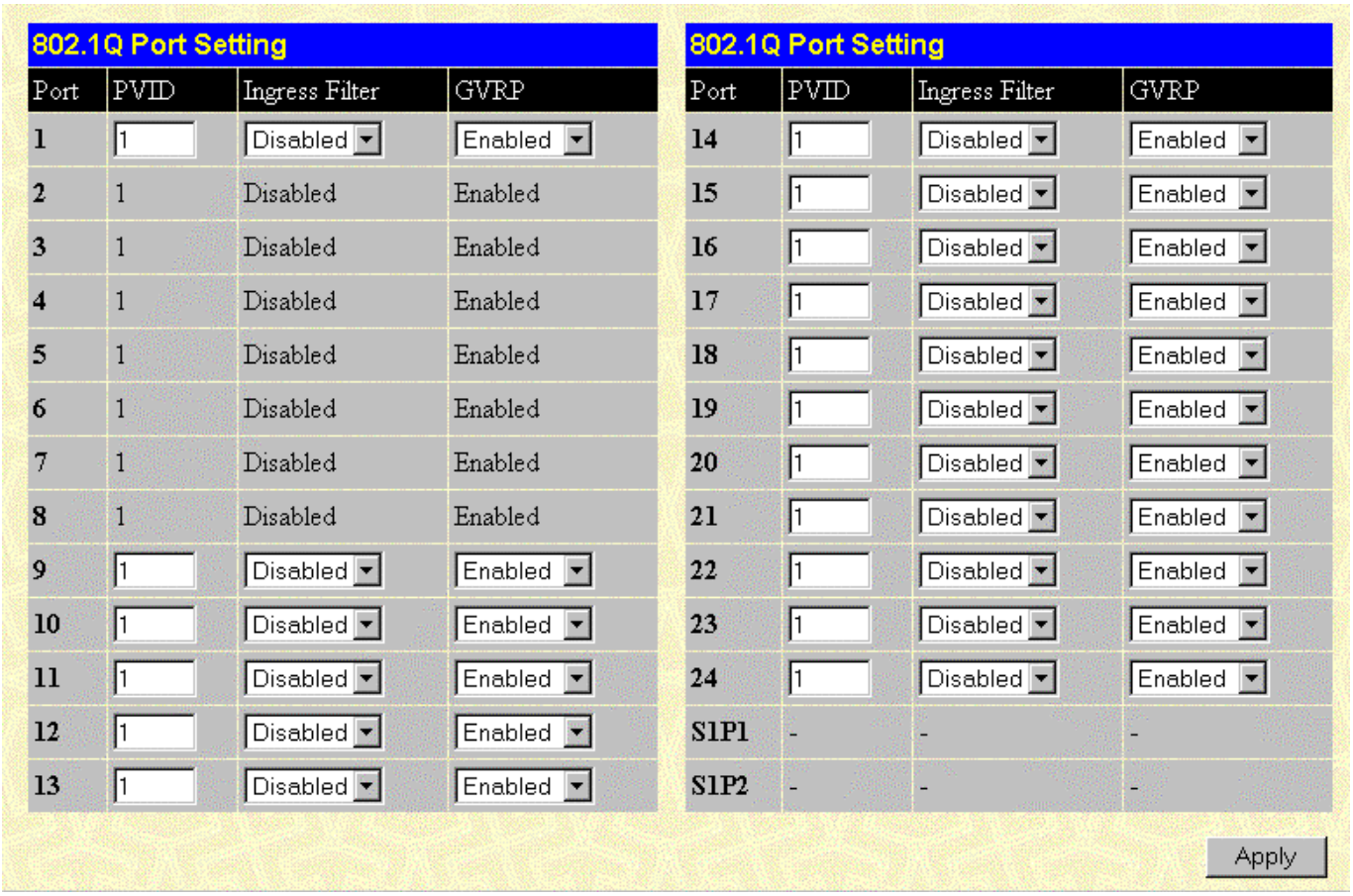


Figure 7-14. 802.1Q Port Setting window

This window allows you to assign a Port VLAN ID (PVID) number, enable or disable the ingress filtering check, and enable or disable GVRP for individual ports.

Ingress filtering means that a receiving port will check to see if it is a member of the VLAN ID in the packet before forwarding the packet. GARP VLAN Registration Protocol (GVRP) is a Generic Attribute Registration Protocol (GARP) application that provides 802.1Q-compliant VLAN pruning and dynamic VLAN creation on 802.1Q trunk ports. With GVRP, the Switch can exchange VLAN configuration information with other GVRP switches, prune unnecessary broadcast and unknown unicast traffic, and dynamically create and manage VLANs on switches connected through 802.1Q trunk ports. (GVRP) on the Switch. Click **Apply** to let your changes take effect.

The information on the window is described as follows:

- **PVID** – The PVID is used by the port to tag outgoing, untagged packets, and to make filtering decisions about incoming packets. If the port is specified as tagging, and an untagged packet if forwarded to the port for transmission, the port will add an 802.1Q tag using the PVID to write the VID in the tag. When the packet arrives at its destination, the receiving device will use the PVID to make VLAN forwarding decisions. If a packet is received by the port, and Ingress filtering is enabled, the port will compare the VID of the incoming packet to its PVID. If the two are unequal, the port will drop the packet. If the two are equal, the port will receive the packet.
- **Ingress Filter** – Specifies the port to check the VID of incoming packets against its VID or PVID. If the two are equal, the port will receive the packet. It the two are unequal, the port will drop the packet. This is used to limit traffic to a single VLAN.
- **GVRP** – For each corresponding port, GARP VLAN Registration Protocol can be *Enabled* or *Disabled*.

Port Bandwidth

The following four windows allow you to set and view ingress and egress bandwidth settings.

Ingress Bandwidth Settings

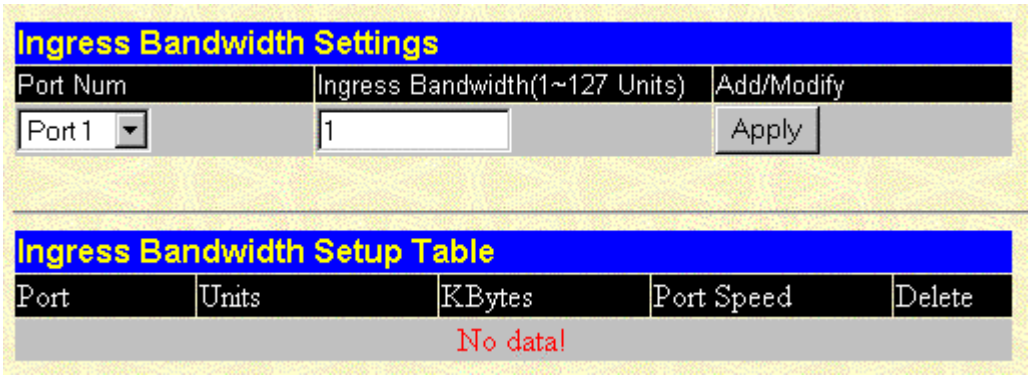


Figure 7-15. Ingress Bandwidth Settings window

To configure ingress bandwidth for a specific port, select the desired port under **Port Num** and enter a bandwidth between 1 and 127 in the next field. Click **Apply** to save the change or addition, and then reboot the Switch to let your changes take effect. To delete an entry, click the Delete icon.

Current Ingress Bandwidth Table

Figure 7-16. Current Ingress Bandwidth Table window

This read-only screen displays current ingress bandwidth information.

Egress Bandwidth Settings

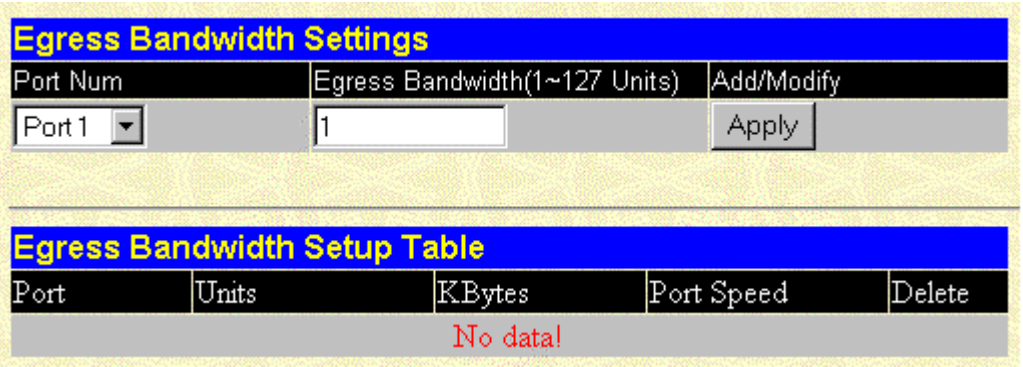


Figure 7-17. Egress Bandwidth Settings window

To configure egress bandwidth for a specific port, select the desired port under **Port Num** and enter a bandwidth between 1 and 127 in the next field. Click **Apply** to save the change or addition, and then reboot the Switch to let your changes take effect. To delete an entry, click the Delete icon.

Current Egress Bandwidth Table

Figure 7-18. Current Egress Bandwidth Table window

This read-only screen displays current egress bandwidth information.

Threshold of Broadcast

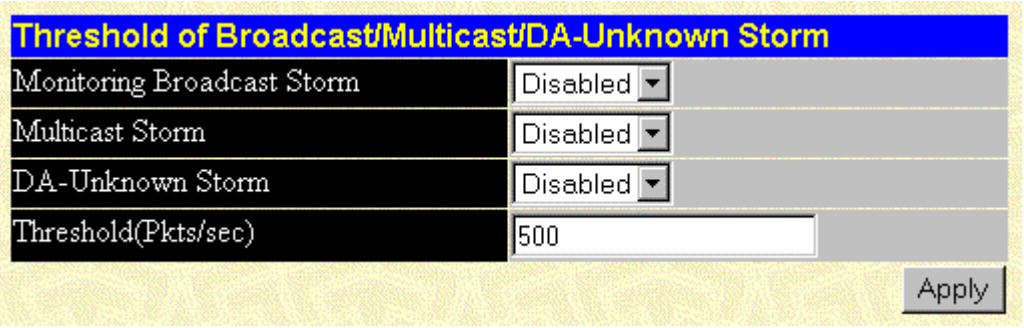
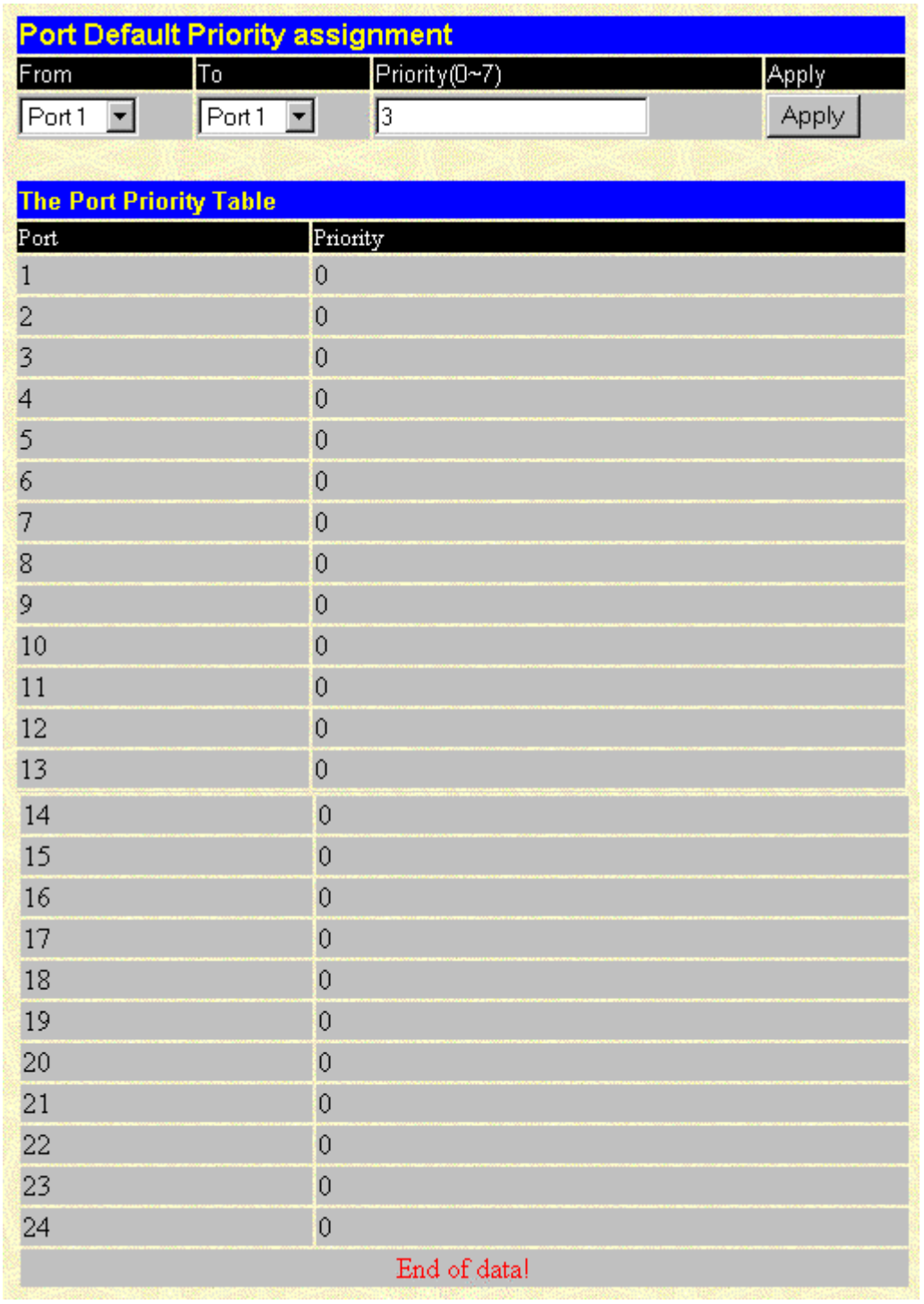


Figure 7-19. Threshold of Broadcast/Multicast/DA-Unknown Storm window

The Switch allows you to set the threshold for three types of storms: broadcast, multicast, and destination address unknown. The higher the threshold, the more packets the Switch can accept per second. If the threshold is exceeded, any additional packets received will be dropped. Entering a low value means packets have a greater chance to exceed the threshold and, thus, be dropped from the Switch.

To use the features on this window, select *Enabled* from the drop-down menu, enter a threshold, and then click **Apply**.

Port Priority



Port Default Priority assignment

From	To	Priority(0~7)	Apply
Port 1	Port 1	3	Apply

The Port Priority Table

Port	Priority
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0

End of data!

Figure 7-20. Port Default Priority assignment window

This window allows you to set a default priority for packets that have not already been assigned a priority value. After filling out the two fields offered, click **Apply** to let your changes take effect.

Class of Traffic

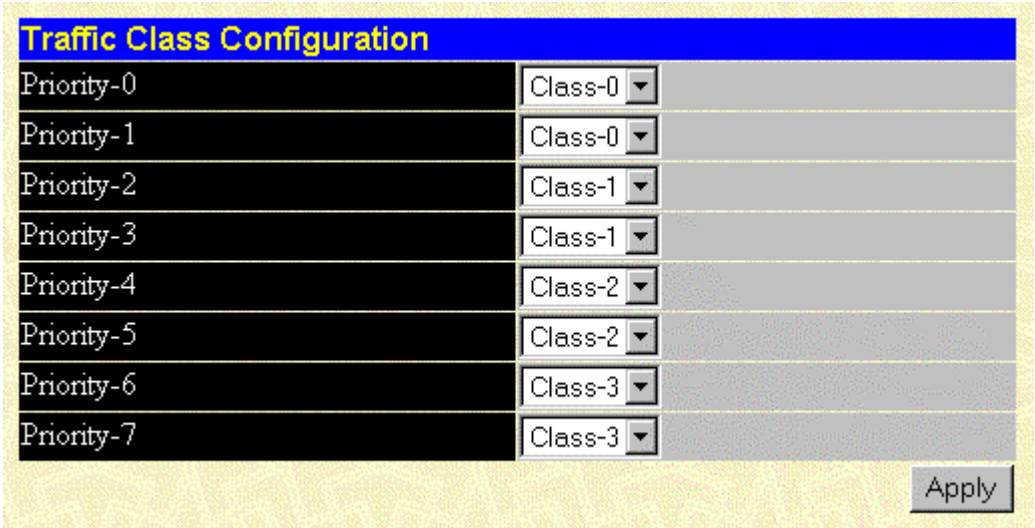


Figure 7-21. Traffic Class Configuration window

This window allows you to configure traffic class priority by specifying the class value, from 0 to 3, of the Switch's eight levels of priority. Click **Apply** to let your changes take effect.

Class of Service

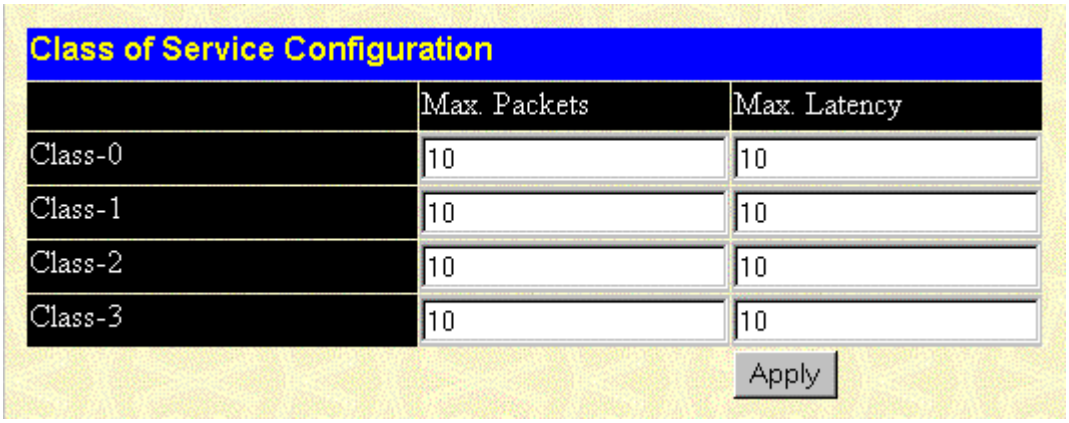


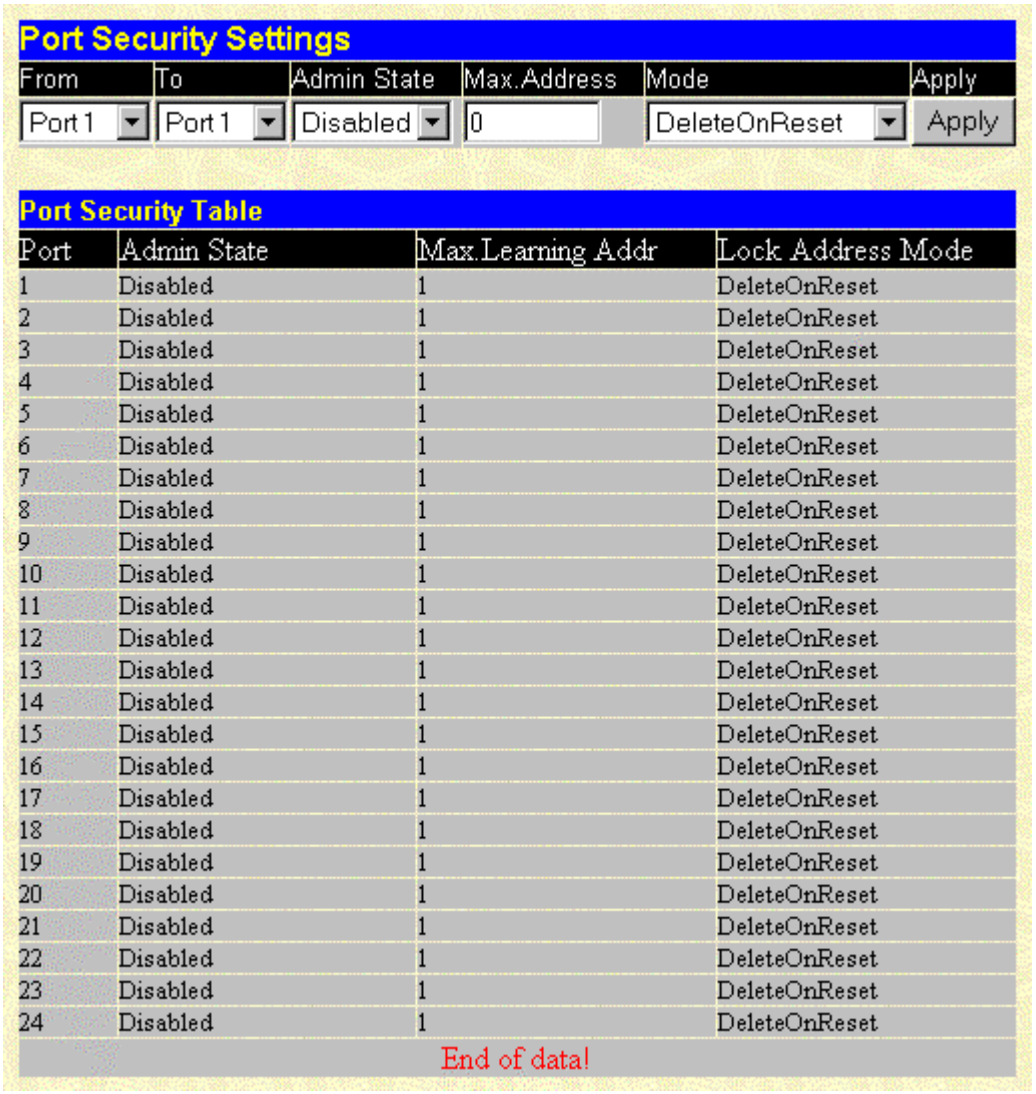
Figure 7-22. Class of Service Configuration window

This window allows you to set the following features:

- **Max. Packets** – The Class of Service scheduling algorithm starts from the highest CoS for a given port, sends the maximum number of packets, then moves on to the next lower CoS. The values that can be entered in this field are from 0 to 255. Entering zero instructs the Switch to continue processing packets until there are no more packets in the CoS transaction queue.

- **Max. Latency** – The maximum allowable time a packet will stay in the CoS queue. The packets in this queue are not delayed more than the maximum allowable latency entered in this field. The timer is disabled when this field is set to zero. Each unit of this timer is equal to 17 microseconds.

Port Security



Port Security Settings

From	To	Admin State	Max.Address	Mode	Apply
Port 1	Port 1	Disabled	0	DeleteOnReset	Apply

Port Security Table

Port	Admin State	Max.Learning Addr	Lock Address Mode
1	Disabled	1	DeleteOnReset
2	Disabled	1	DeleteOnReset
3	Disabled	1	DeleteOnReset
4	Disabled	1	DeleteOnReset
5	Disabled	1	DeleteOnReset
6	Disabled	1	DeleteOnReset
7	Disabled	1	DeleteOnReset
8	Disabled	1	DeleteOnReset
9	Disabled	1	DeleteOnReset
10	Disabled	1	DeleteOnReset
11	Disabled	1	DeleteOnReset
12	Disabled	1	DeleteOnReset
13	Disabled	1	DeleteOnReset
14	Disabled	1	DeleteOnReset
15	Disabled	1	DeleteOnReset
16	Disabled	1	DeleteOnReset
17	Disabled	1	DeleteOnReset
18	Disabled	1	DeleteOnReset
19	Disabled	1	DeleteOnReset
20	Disabled	1	DeleteOnReset
21	Disabled	1	DeleteOnReset
22	Disabled	1	DeleteOnReset
23	Disabled	1	DeleteOnReset
24	Disabled	1	DeleteOnReset

End of data!

Figure 7-23. Port Security Settings window

To set up security for a port or ports, enter the port or ports in the first two fields, change the **Admin State** to *Enabled*, enter the maximum number of addresses, the desired **Mode**, and then click **Apply**.

Management

This category includes: **Security IP**, **SNMP Manager**, **Trap Manager**, and **User Accounts**.

Security IP

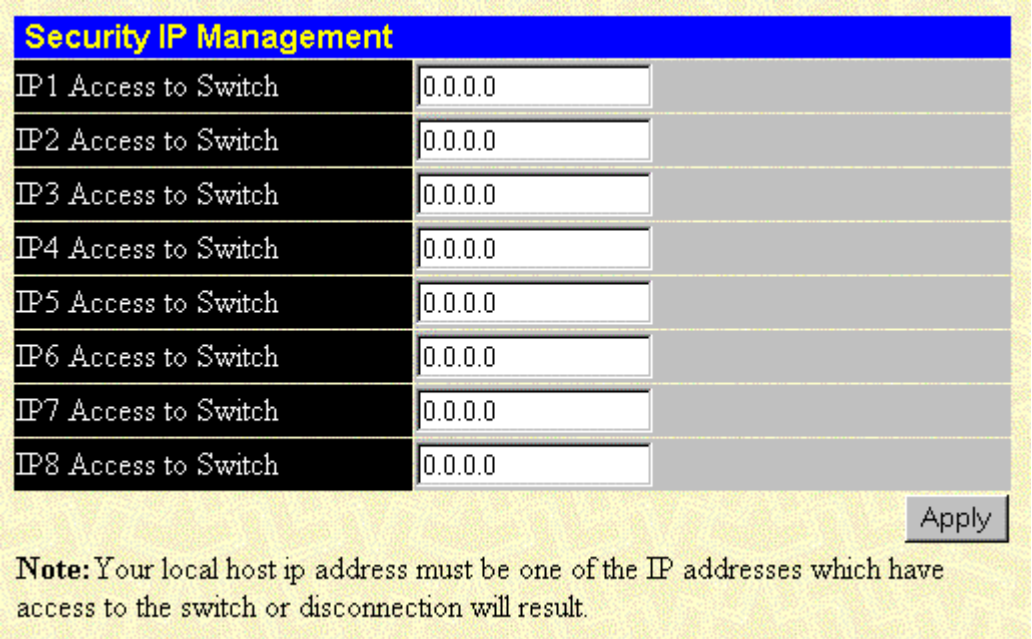


Figure 7-24. Security IP Management window

Use this window to specify IP addresses that are allowed to access the Switch.

SNMP Manager

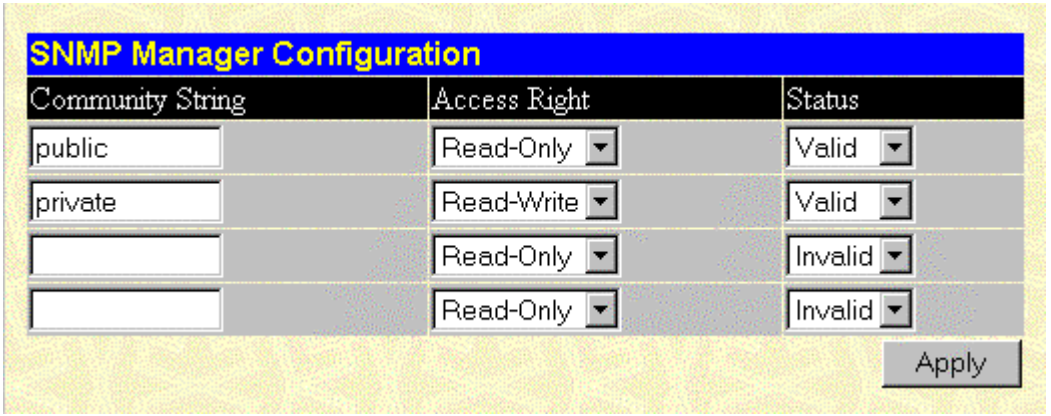


Figure 7-25. SNMP Manager Configuration window

To use the functions on this window, enter the appropriate SNMP information. You may enter up to four entries. Click **Apply** to put the settings into effect.

The Community String information is described as follows:

- **Community String** – A user-defined SNMP community name.
- **Access Right** – The permitted access of *Read-Only* or *Read-Write* using the SNMP community name.
- **Status** – Option to set the current community string to *Valid* or *Invalid*.

Trap Manager

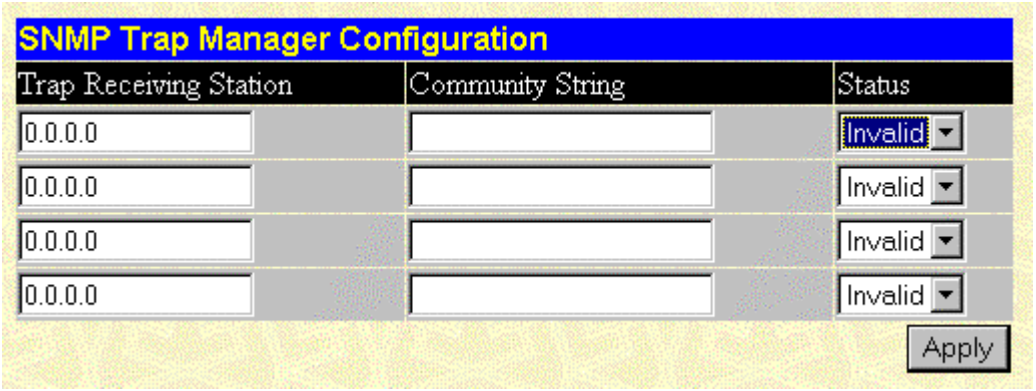


Figure 7-26. SNMP Trap Manager Configuration window

A trap receiving station is a device that constantly runs a network management application to receive and store traps. You may enter up to four entries. Click **Apply** to put the settings into effect.

The information is described as follows:

- **Trap Receiving Station** – The IP address of the trap receiving station.
- **Community String** – A user-defined SNMP community name.
- **Status** – Option to set the trap receiving station to *Valid* or *Invalid*.

User Accounts

The Switch allows you to set up and manage user accounts in the following two windows.

User Account Management

Figure 7-27. User Account Management window

The information on the window is described as follows:

- **User Name** – Displays all current users for the Switch.
- **Access Right** – Displays the current access level assigned to each corresponding user. There are three access levels: *User*, *User+*, and *Root*. A *Root* user has full read/write access, while a *User* has read only access. A *User+* has the same privileges as a User, but with the added ability to restart the Switch.
- **New** – Select this hyperlink to add a new user to the table.

User Account Modify Table

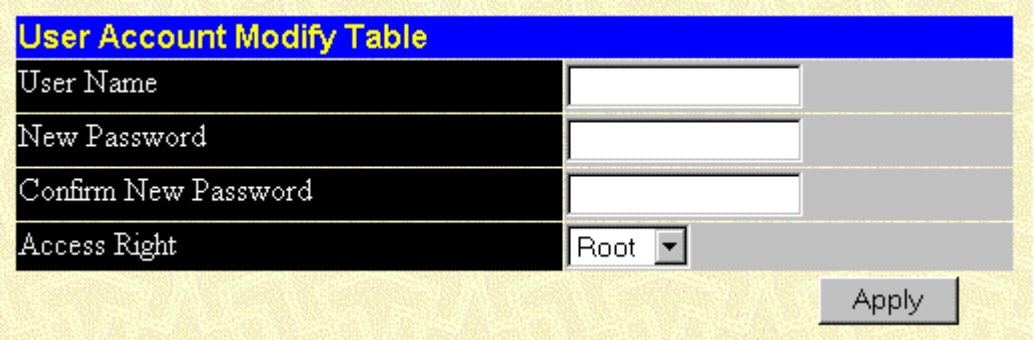


Figure 7-28. User Account Modify Table window

To add or delete a User Account, fill in the appropriate information in the User Name, New Password, and Confirm New Password fields. Then select the desired access, *Root*, *User* or *User+*, in the **Access Right** control and click **Apply**.

The information on the window is described as follows:

- **User Name** – Enter a user name in this field.
- **New Password** – Enter the desired new password in this field.
- **Confirm New Password** – Enter the new password a second time.
- **Access Right** – Displays the current access level assigned to each corresponding user. There are three access levels: User, User+, and Root. A Root user has full read/write access, while a User has read only access. A User+ has the same privileges as a User, but with the added ability to restart the Switch.

Monitoring

This category includes: **Port Utilization**, **Packets** (**Received (RX)**, **MBU_cast (RX)**, and **Transferred (TX)**), **Errors** (**Received (RX)** and **Transferred (TX)**), **Size** (**Received (RX)**), **MAC Address Table**, **IGMP Snooping Table**, **VLAN Multicast Table**, **IGMP Multicast Table**, and **VLAN Status Table**.

Port Utilization

The Switch can display the utilization percentage of a specified port in the window below.

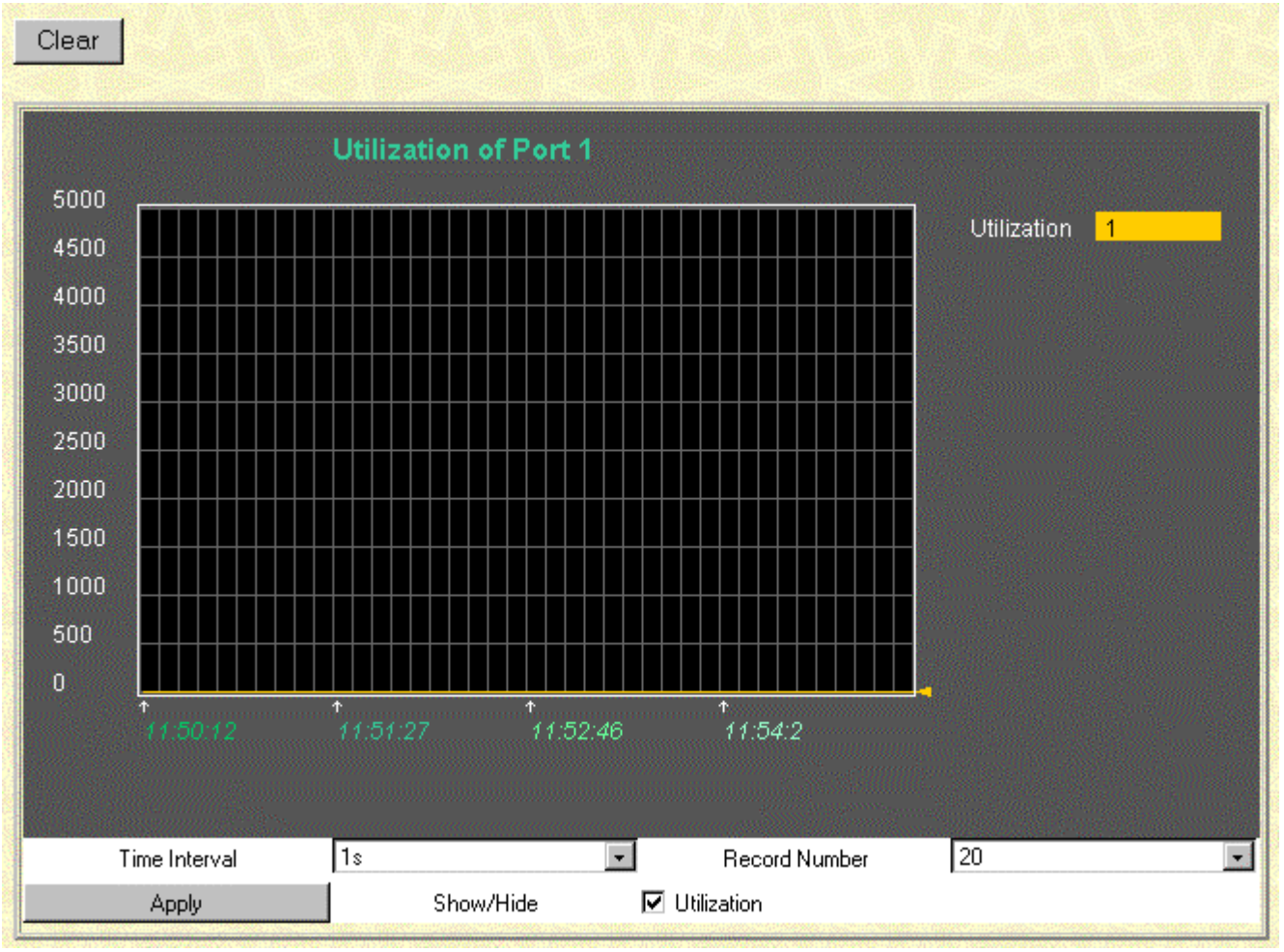


Figure 7-29. Utilization window

The information is described as follows:

- **Time Interval –** Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
- **Record Number –** Select number of times the Switch will be polled between *20* and *200*. The default value is 20.
- **Show/Hide –** Check whether or not to display Utilization.
- **Clear –** Clicking this button clears all statistics counters on this window.

Packets

The Web Manager allows various packet statistics to be viewed as either a line graph or a table. The six windows offered are as follows:

Received (RX)

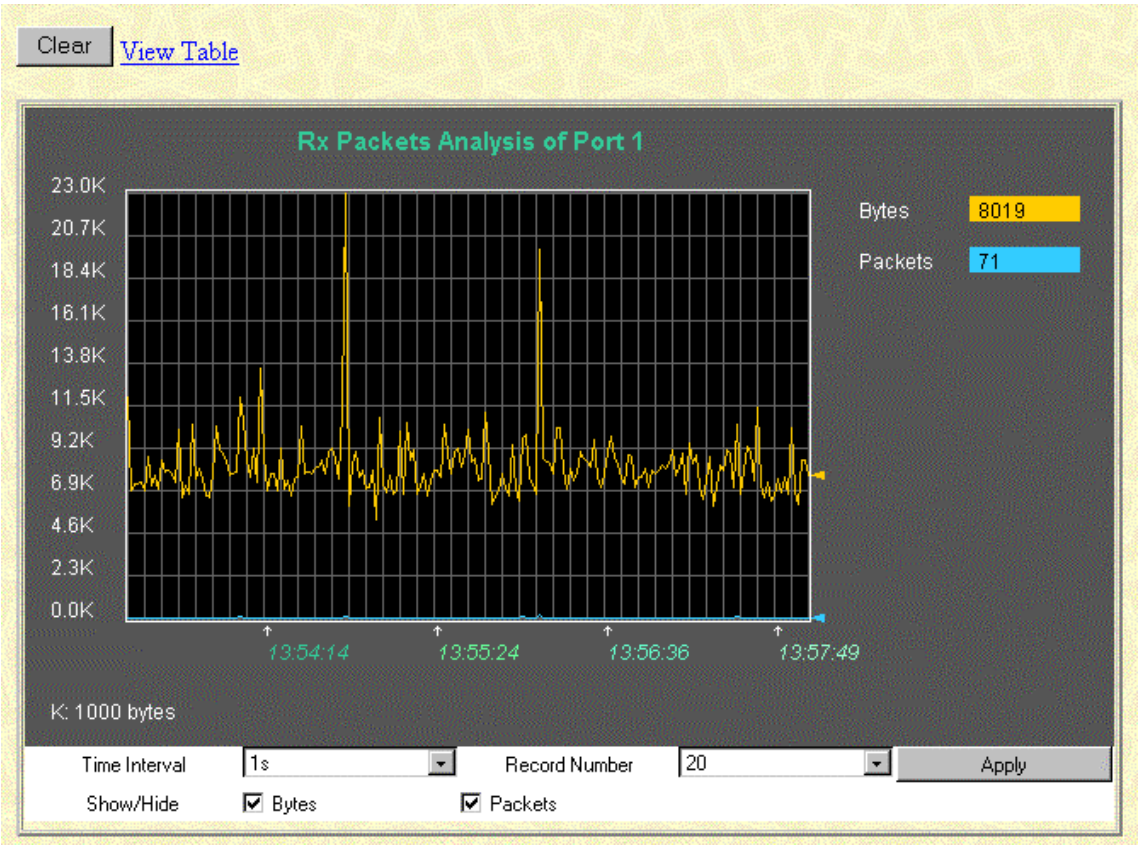


Figure 7-30. Rx Packets Analysis window (Line Chart)

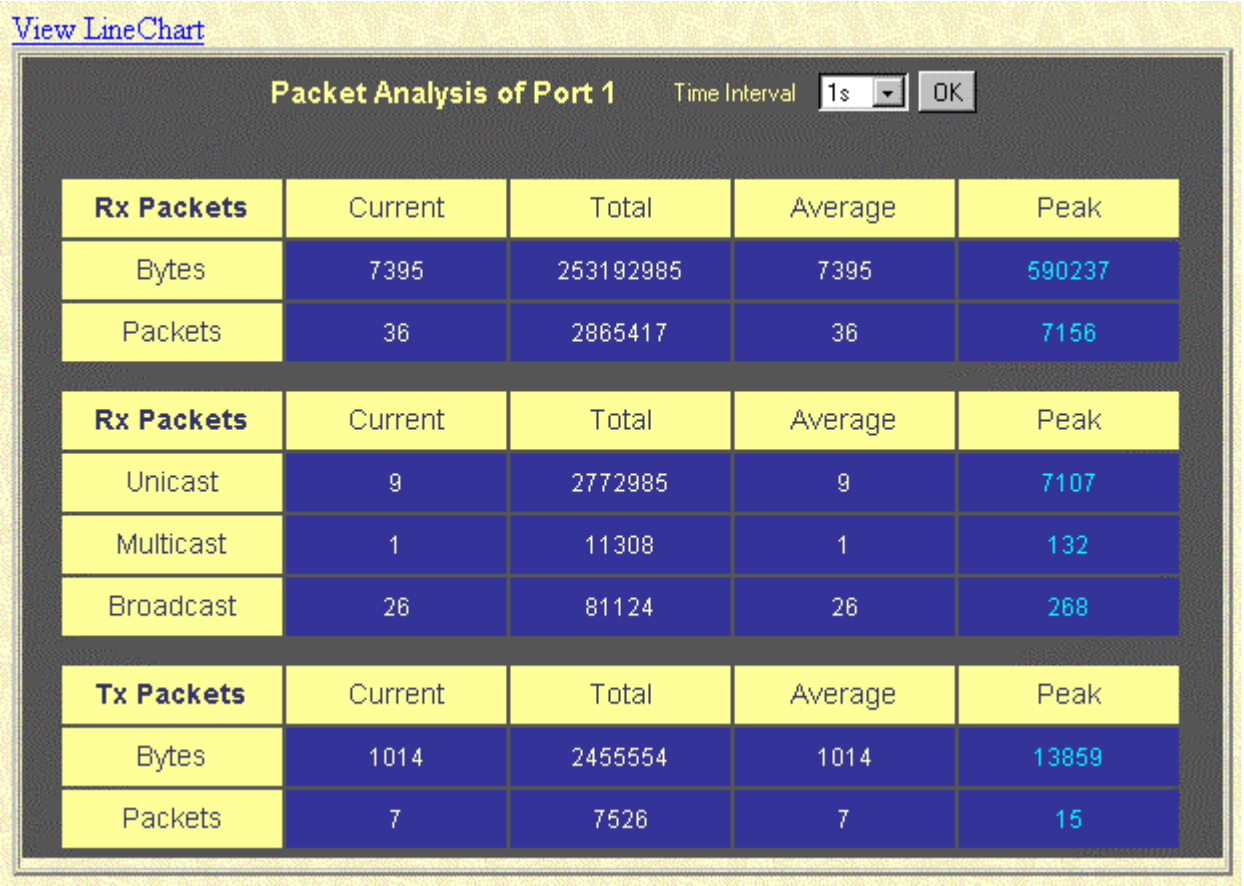


Figure 7-31. Rx Packets Analysis window (Table)

The information is described as follows:

- **Time Interval –** Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
- **Record Number –** Select number of times the Switch will be polled between *20* and *200*. The default value is 20.
- **Bytes –** Counts the number of bytes received on the port.
- **Packets –** Counts the number of packets received on the port.
- **Show/Hide –** Check whether or not to display Bytes and Packets.
- **Clear –** Clicking this button clears all statistics counters on this window.
- **View Table –** Clicking this button instructs the Switch to display a table rather than a line graph.
- **View Line Chart –** Clicking this button instructs the Switch to display a line graph rather than a table.

MBU-cast (RX)

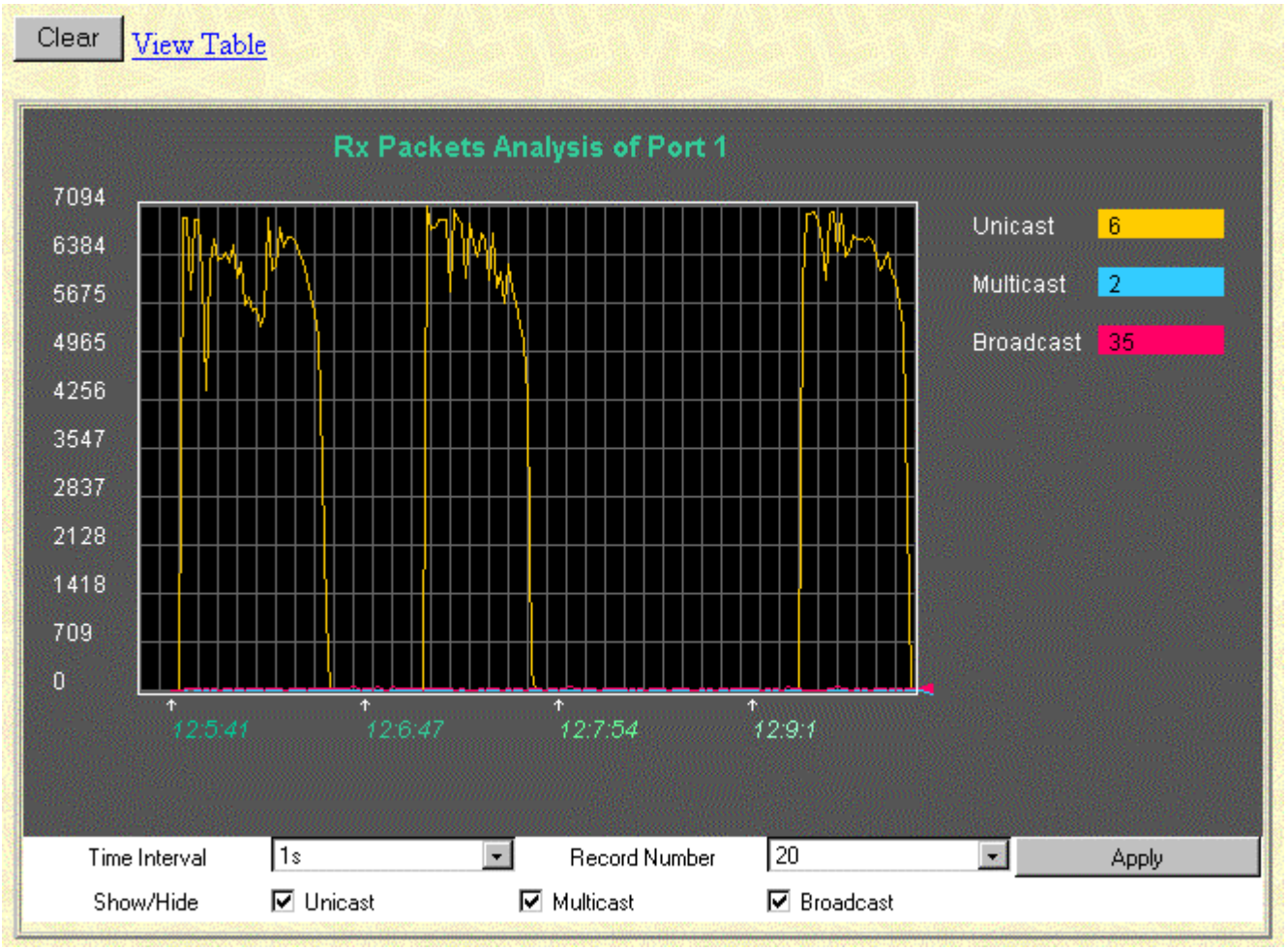


Figure 7-32. Rx Packets Analysis window for MBU (Line Chart)

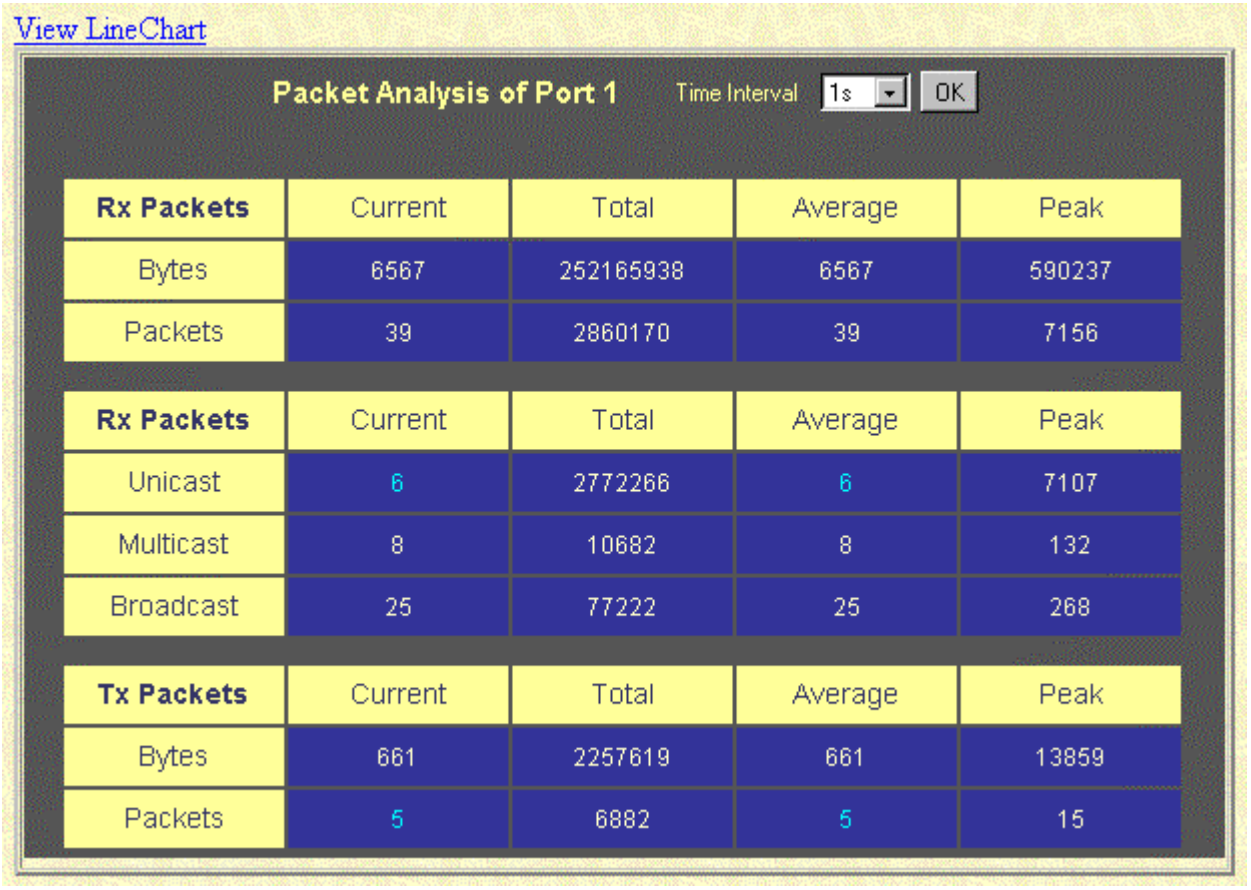


Figure 7-33. Rx Packets Analysis window for MBU (Table)

The information is described as follows:

- **Time Interval –** Select the desired setting between *1s* and *60s*, where "s" stands for seconds.
- **Record Number –** Select number of times the Switch will be polled between *20* and *200*.
- **Multicast –** Counts the total number of good packets that were received by a multicast address.
- **Broadcast –** Counts the total number of good packets that were received by a broadcast address.
- **Unicast –** Counts the total number of good packets that were received by a unicast address.
- **Show/Hide –** Check whether or not to display Multicast, Broadcast, and Unicast Packets.
- **Clear –** Clicking this button clears all statistics counters on this window.
- **View Table –** Clicking this button instructs the Switch to display a table rather than a line graph.
- **View Line Chart –** Clicking this button instructs the Switch to display a line graph rather than a table.

Transferred (TX)

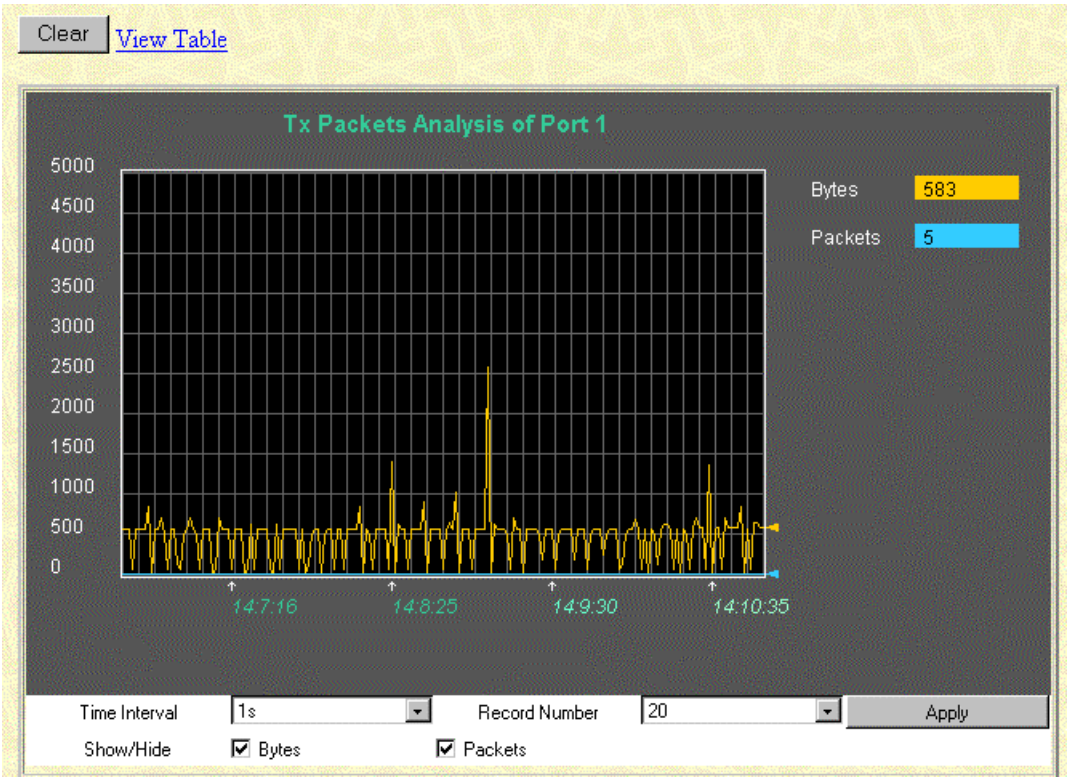


Figure 7-34. Tx Packets Analysis window (Line Chart)

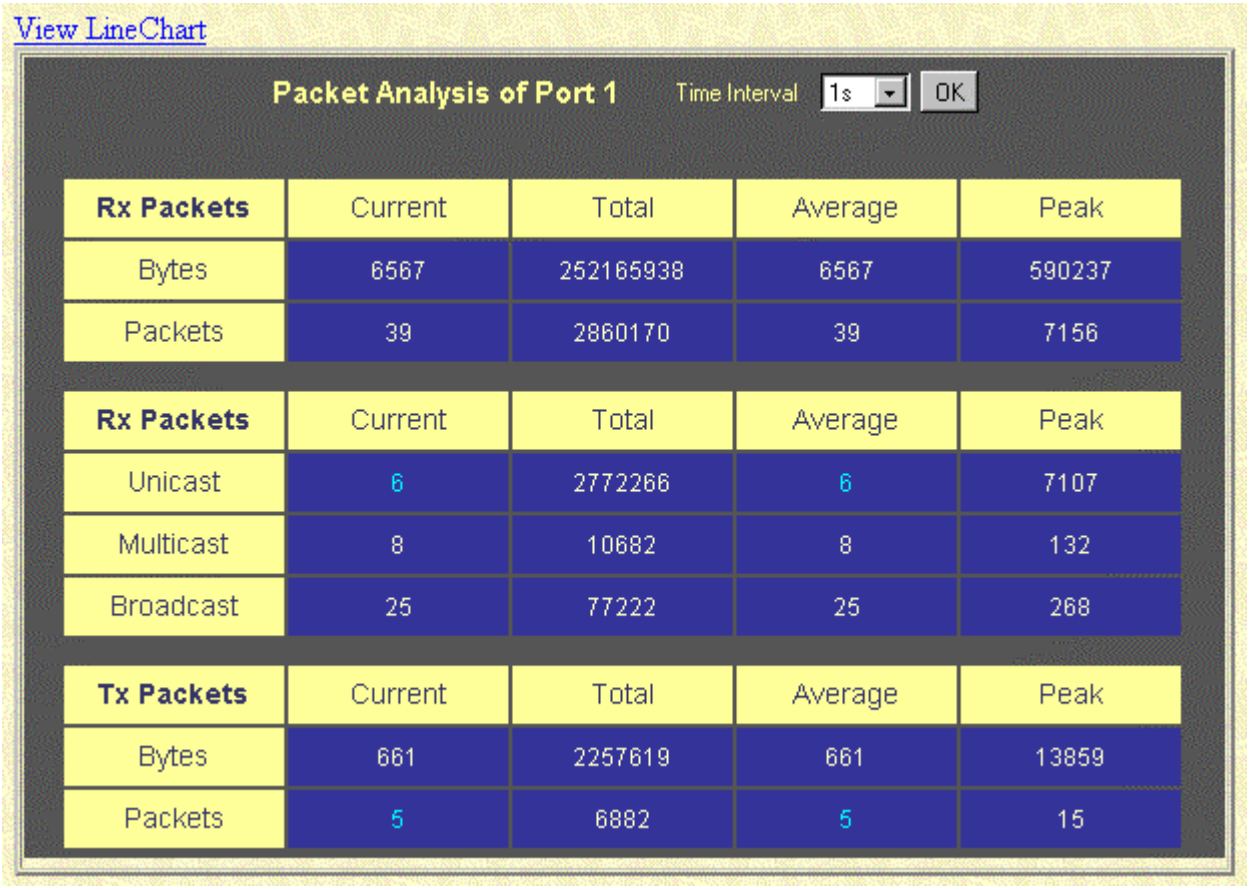


Figure 7-35. Tx Packets Analysis window (Table)

The information is described as follows:

- **Time Interval –** Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
- **Record Number –** Select number of times the Switch will be polled between *20* and *200*. The default value is 20.
- **Bytes –** Counts the number of bytes successfully sent from the port.
- **Packets –** Counts the number of packets successfully sent on the port.
- **Show/Hide –** Check whether or not to display Bytes and Packets.
- **Clear –** Clicking this button clears all statistics counters on this window.
- **View Table –** Clicking this button instructs the Switch to display a table rather than a line graph.
- **View Line Chart –** Clicking this button instructs the Switch to display a line graph rather than a table.

Errors

The Web Manager allows port error statistics compiled by the Switch's management agent to be viewed as either a line graph or a table. The four windows offered are as follows:

Received (RX)

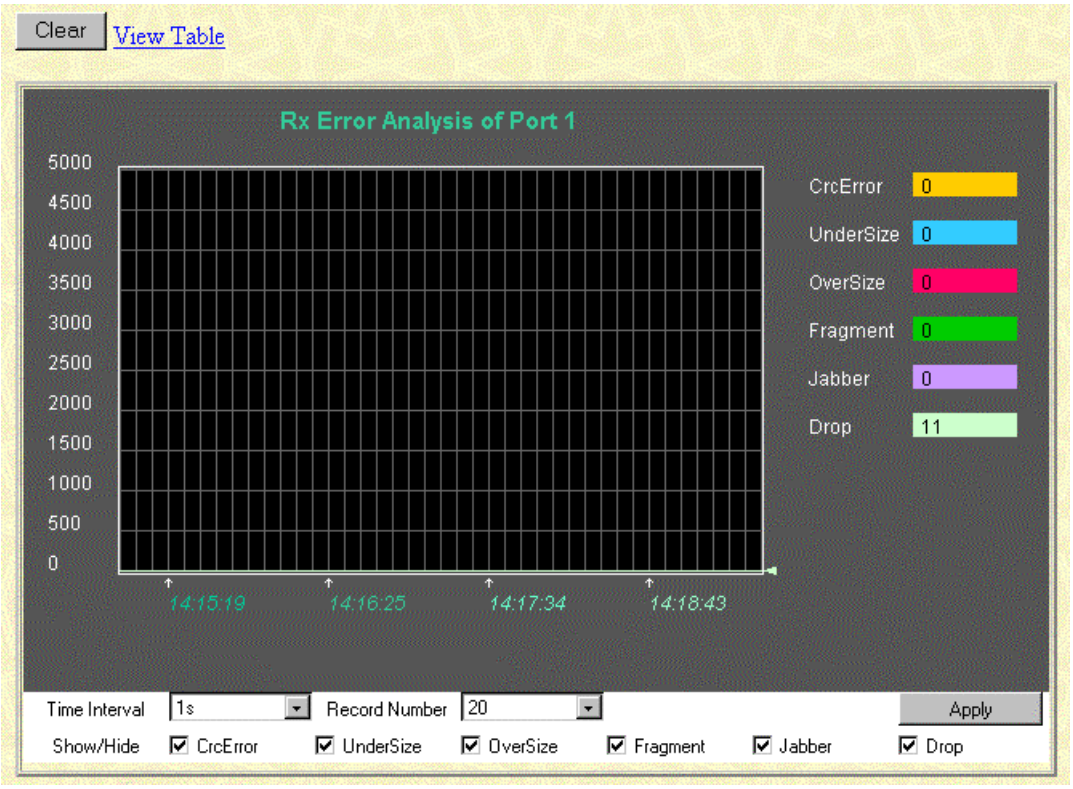
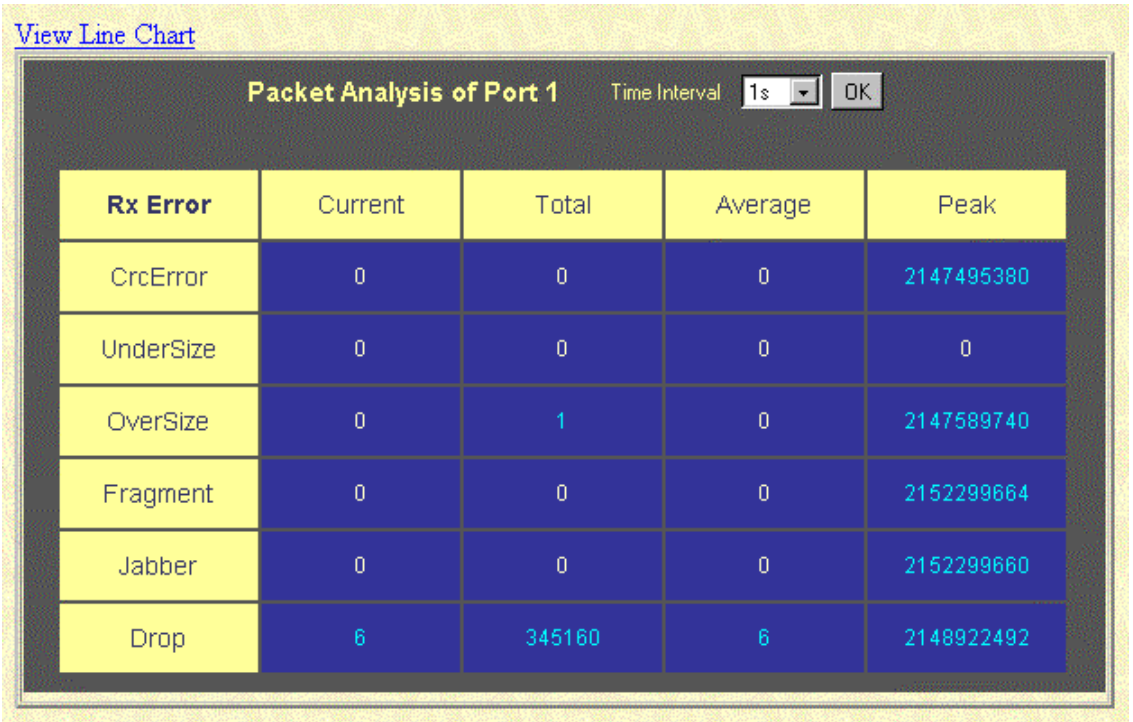


Figure 7-36. Rx Error Analysis window (Line Chart)



Rx Error	Current	Total	Average	Peak
CrcError	0	0	0	2147495380
UnderSize	0	0	0	0
OverSize	0	1	0	2147589740
Fragment	0	0	0	2152299664
Jabber	0	0	0	2152299660
Drop	6	345160	6	2148922492

Figure 7-37. Rx Error Analysis window (Table)

The information is described as follows:

- **Time Interval –** Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
- **Record Number –** Select number of times the Switch will be polled between *20* and *200*. The default value is 20.
- **CRCError –** Counts otherwise valid frames that did not end on a byte (octet) boundary.
- **UnderSize –** The number of frames detected that are less than the minimum permitted frame size of 64 bytes and have a good CRC. Undersize frames usually indicate collision fragments, a normal network occurrence.
- **OverSize –** Counts packets received that were longer than 1518 octets, or if a VLAN frame, 1522 octets and less than the MAX_PKT_LEN. Internally, MAX_PKT_LEN is equal to 1522.
- **Fragment –** The number of packets less than 64 bytes with either bad framing or an invalid CRC. These are normally the result of collisions.
- **Jabber –** The number of frames with lengths more than the MAX_PKT_LEN bytes. Internally, MAX_PKT_LEN is equal to 1522.
- **Drop –** The number of frames which are dropped by this port since the last Switch reboot.
- **Show/Hide –** Check whether or not to display CrcError, UnderSize, OverSize, Fragment, Jabber, and Drop errors.
- **Clear –** Clicking this button clears all statistics counters on this window.
- **View Table –** Clicking this button instructs the Switch to display a table rather than a line graph.
- **View Line Chart –** Clicking this button instructs the Switch to display a line graph rather than a table.

Transferred (TX)

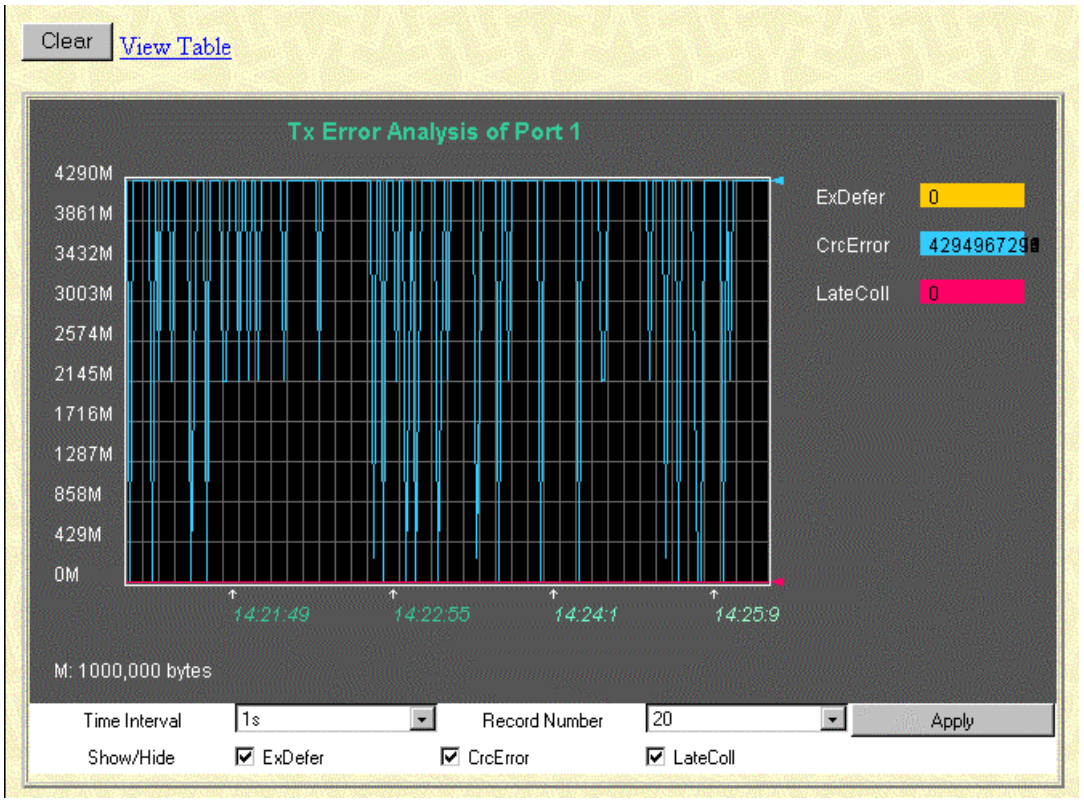


Figure 7-38. Tx Error Analysis window (Line Chart)

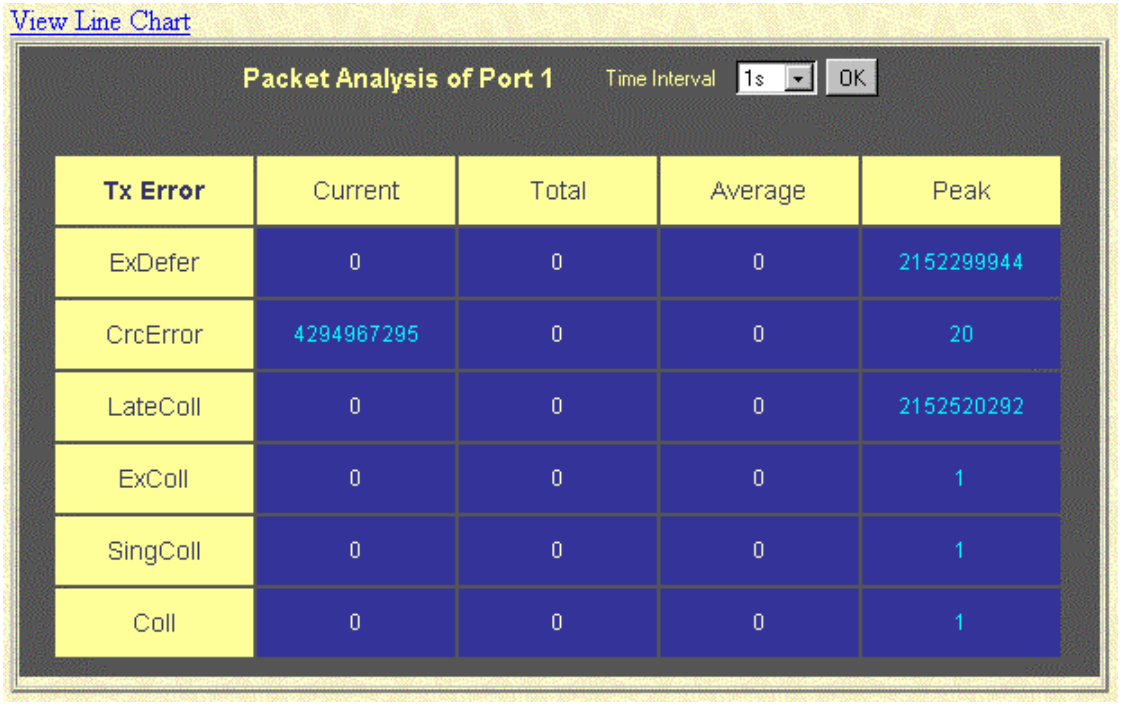


Figure 7-39. Tx Error Analysis window (Table)

The information is described as follows:

- **Time Interval –** Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.
- **Record Number –** Select number of times the Switch will be polled between *20* and *200*. The default value is 20.
- **ExDefer –** Counts the number of frames for which the first transmission attempt on a particular interface was delayed because the medium was busy.
- **CRCError –** Counts otherwise valid frames that did not end on a byte (octet) boundary.
- **LateColl –** Counts the number of times that a collision is detected later than 512 bit-times into the transmission of a packet.
- **Show/Hide –** Check whether or not to display ExDefer, CrcError, and LateColl errors.
- **Clear –** Clicking this button clears all statistics counters on this window.
- **View Table –** Clicking this button instructs the Switch to display a table rather than a line graph.
- **View Line Chart –** Clicking this button instructs the Switch to display a line graph rather than a table.

Size

The Web Manager allows packets received by the Switch, arranged in six groups, to be viewed as either a line graph or a table. The two windows offered are as follows:

Received (RX)

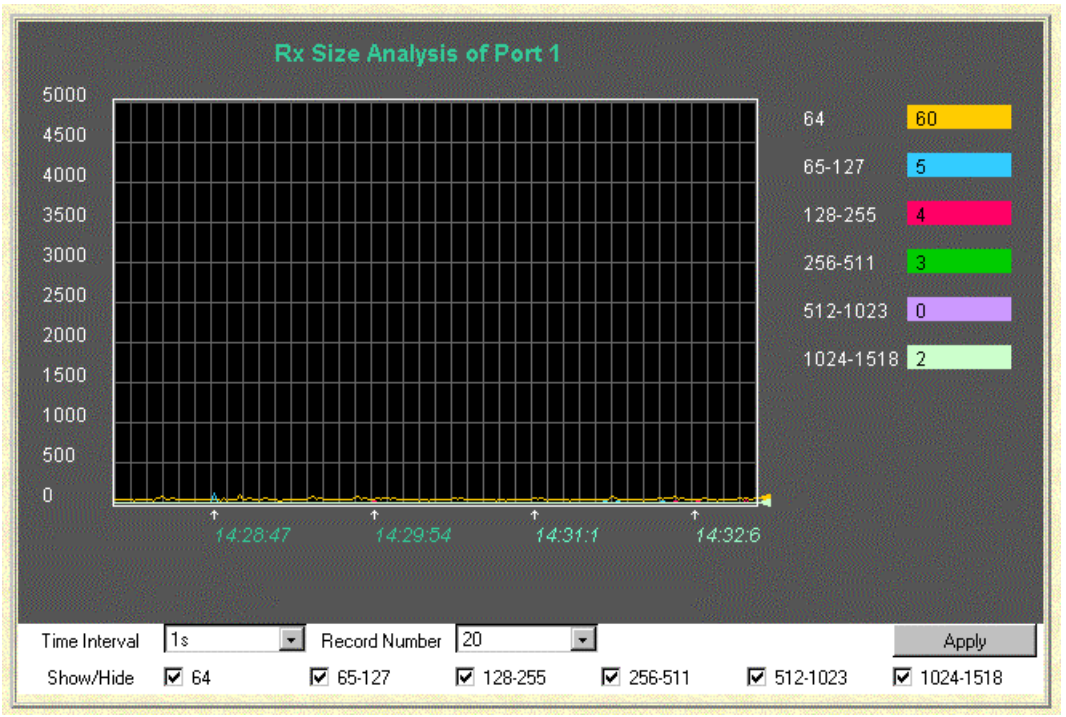
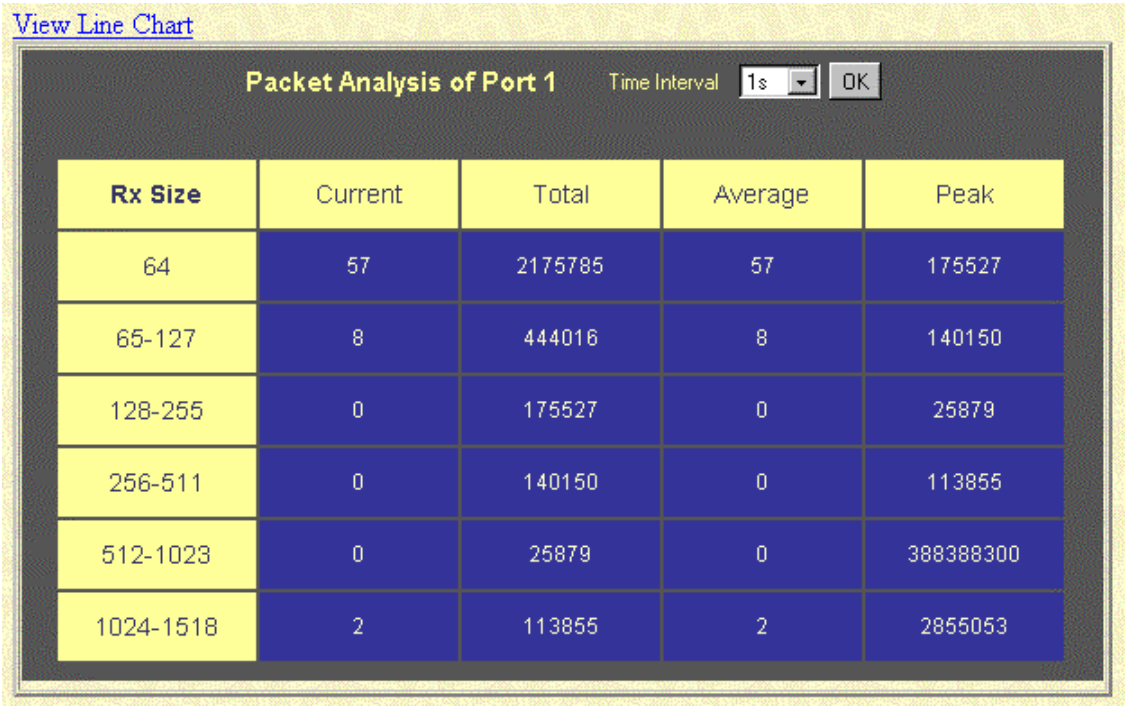


Figure 7-40. Rx Size Analysis window (Line Chart)



Rx Size	Current	Total	Average	Peak
64	57	2175785	57	175527
65-127	8	444016	8	140150
128-255	0	175527	0	25879
256-511	0	140150	0	113855
512-1023	0	25879	0	388388300
1024-1518	2	113855	2	2855053

Figure 7-41. Rx Size Analysis window (Table)

The information is described as follows:

- **Time Interval –** Select the desired setting between *1s* and *60s*, where "s" stands for seconds. The default value is one second.

- **Record Number –** Select number of times the Switch will be polled between *20* and *200*. The default value is 20.
- **64 –** The total number of packets (including bad packets) received that were 64 octets in length (excluding framing bits but including FCS octets).
- **65-127 –** The total number of packets (including bad packets) received that were between 65 and 127 octets in length inclusive (excluding framing bits but including FCS octets).
- **128–255 –** The total number of packets (including bad packets) received that were between 128 and 255 octets in length inclusive (excluding framing bits but including FCS octets).
- **256-511 –** The total number of packets (including bad packets) received that were between 256 and 511 octets in length inclusive (excluding framing bits but including FCS octets).
- **512-1023 –** The total number of packets (including bad packets) received that were between 512 and 1023 octets in length inclusive (excluding framing bits but including FCS octets).
- **1024-1518 –** The total number of packets (including bad packets) received that were between 1024 and 1518 octets in length inclusive (excluding framing bits but including FCS octets).
- **Show/Hide –** Check whether or not to display 64, 65-127, 128-255, 256-511, 512-1023, and 1024-1518 packets received.
- **Clear –** Clicking this button clears all statistics counters on this window.
- **View Table –** Clicking this button instructs the Switch to display a table rather than a line graph.
- **View Line Chart –** Clicking this button instructs the Switch to display a line graph rather than a table.

MAC Address Table

The Web Manager allows the Switch's MAC address table (sometimes referred to as a forwarding table) to be viewed:

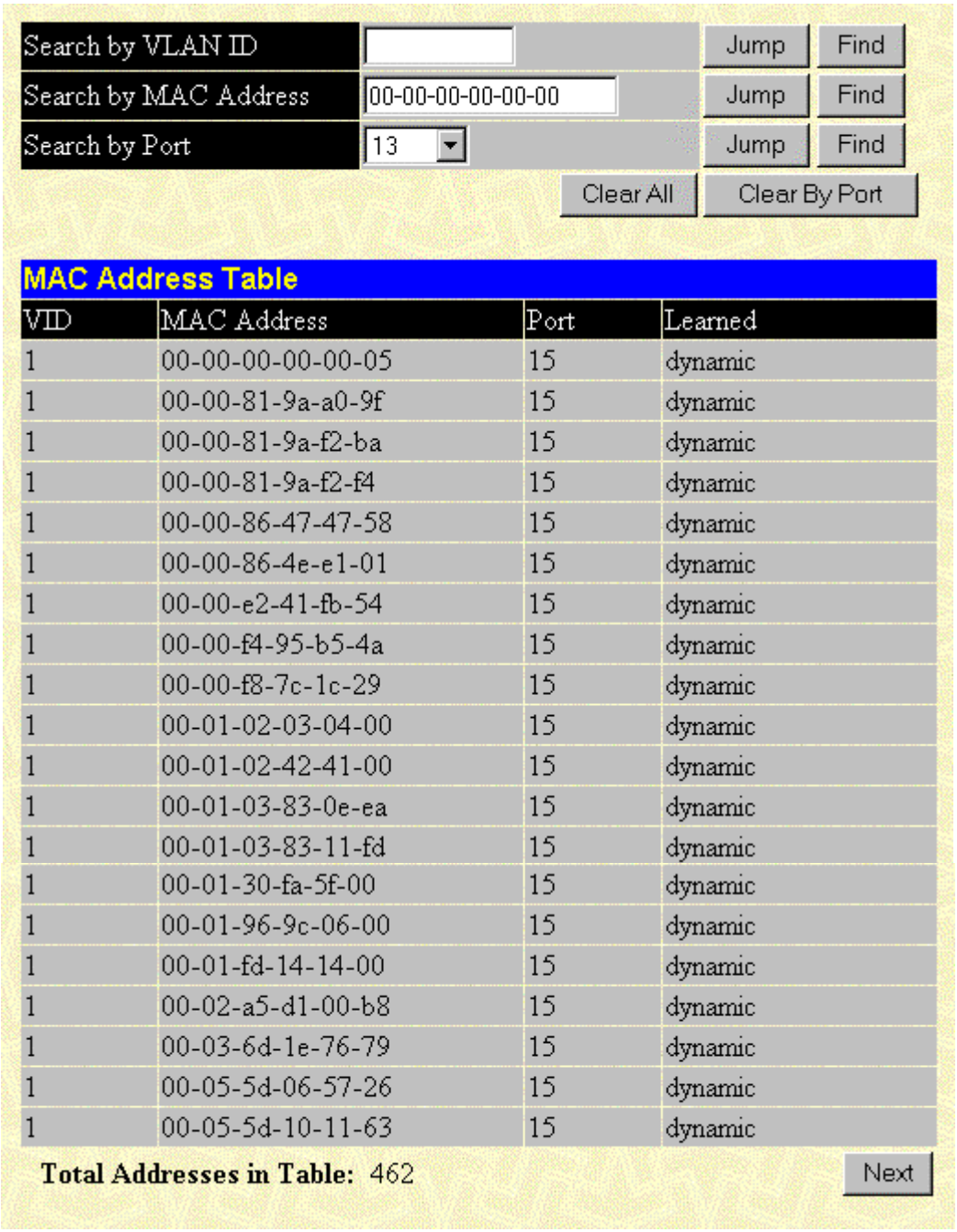


Figure 7-42. MAC Address Table window

The information is described as follows:

- **Search by VLAN ID** – Allows the forwarding table to be browsed by VLAN ID (VID).
- **Search by MAC Address** – Allows the forwarding table to be browsed by MAC Address.
- **Search by Port** – Allows the forwarding table to be browsed by port number.
- **Jump** – Allows the user to move to a sector of the database corresponding to a user defined port, VLAN, or MAC address.
- **Find** – Click the icon to find the data entry.

- **Clear All** – Clears all forwarding table entries.
- **Clear By Port** – Clears the forwarding table entries that have the entered port number.
- **VID** – The VLAN ID of the VLAN the port is a member of.
- **MAC Address** – The MAC address entered into the address table.
- **Port** – The port that the MAC address above corresponds to.
- **Learned** – How the switch discovered the MAC address. The possible entries are *Dynamic*, *Self*, and *Static*.
- **Next** – Click this button to view the next page of the address table.

IGMP Snooping Table

The Switch's IGMP snooping table can be browsed using the Web Manager. The table is displayed by VLAN ID (VID).

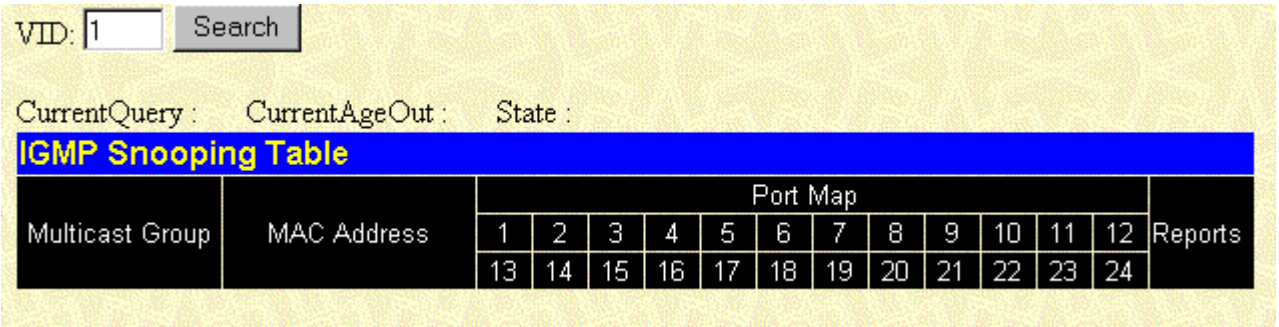


Figure 7-43. IGMP Snooping Table window

The information is described as follows:

- **VID** –VLAN ID of the VLAN for which the IGMP Snooping table is to be displayed.
- **Search** – Click on the View button to display the IGMP Snooping Table for the current VID.
- **Multicast Group** – The IP address of a multicast group learned by IGMP snooping.
- **MAC Address** – The corresponding MAC address learned by IGMP snooping.
- **Port Map** – Displays the ports that have forwarded multicast packets.
- **Reports** – The number of IGMP reports for the listed source.

VLAN Multicast Table

This read-only table displays VLAN multicast information.

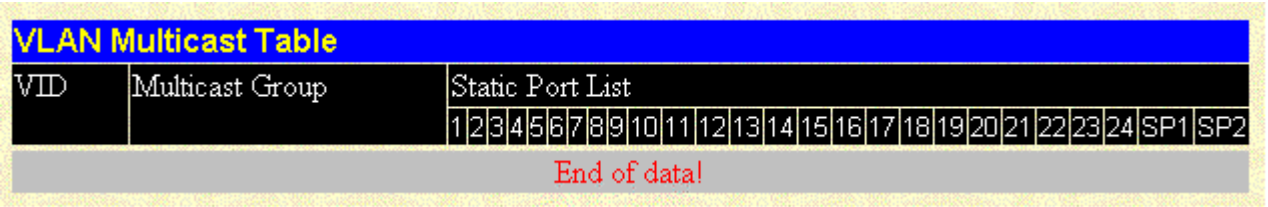

VLAN Multicast Table
VID
Multicast Group
Static Port List
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 SP1 SP2
End of data!

Figure 7-44. VLAN Multicast Table window

The information is described as follows:

- **VID** –VLAN ID of the VLAN for which the multicast table is displayed.
- **Multicast Group** – The IP address of a multicast group learned through multicasting.
- **Static Port List** – Displays the ports that have forwarded multicast packets.

IGMP Multicast Table

This read-only table displays IGMP multicast information.

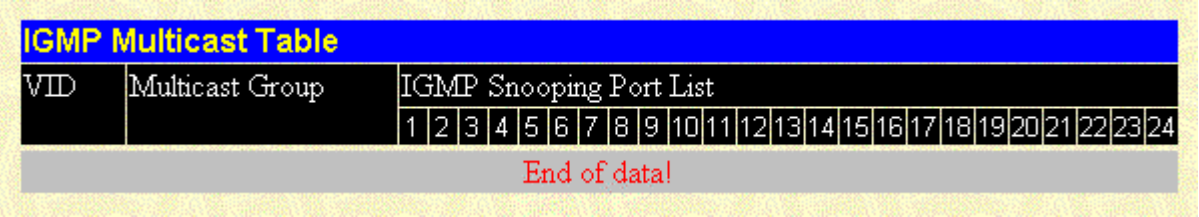

IGMP Multicast Table
VID
Multicast Group
IGMP Snooping Port List
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
End of data!

Figure 7-45. IGMP Multicast Table window

The information is described as follows:

- **VID** –VLAN ID of the VLAN for which the IGMP multicast table is displayed.
- **Multicast Group** – The IP address of a multicast group learned through IGMP snooping.
- **IGMP Snooping Port List** – Displays the ports that have forwarded multicast packets.

VLAN Status Table

This window displays which VLAN ports are egress and which ports are untagged.

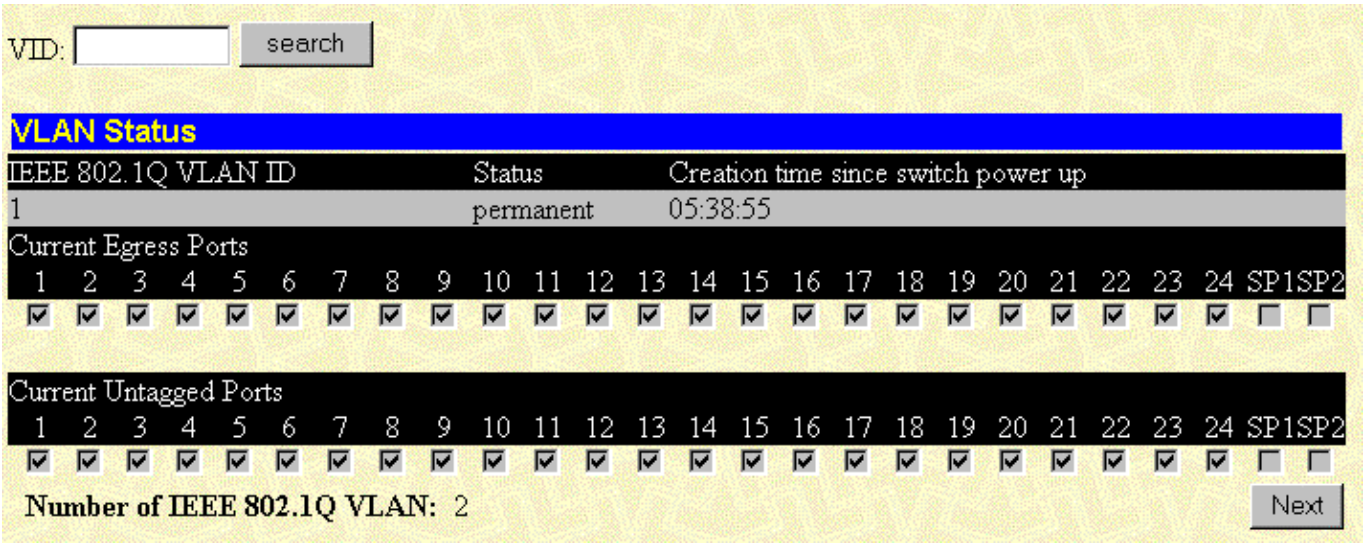

VID:
search
VLAN Status
IEEE 802.1Q VLAN ID
Status
Creation time since switch power up
1
permanent
05:38:55
Current Egress Ports
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 SP1 SP2
Current Untagged Ports
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 SP1 SP2
Number of IEEE 802.1Q VLAN: 2
Next

Figure 7-46. VLAN Status window

Enter a VLAN ID number and click **search** to display the **VLAN Status** window for the desired VLAN.

The information is described as follows:

- **IEEE 802.1Q VLAN ID** – The VLAN for which the VLAN table is displayed.
- **Status** – This indicates the current status of the VID listed above.
- **Creation time since switch power up** – The hours, minutes, and seconds since the Switch was last rebooted.
- **Current Egress Ports** – Displays the current egress ports on the VLAN.
- **Current Untagged Ports** – Displays the current untagged ports on the VLAN.
- **Prev** – Click this button to move to the previous VLAN.
- **Next** – Click this button to move to the next VLAN.

Maintenance

This category includes **TFTP Services** (**Update Firmware**, **Configuration File**, **Save Settings**, and **Save History Log**), **Switch History**, **Ping Test**, **Save Changes**, **Factory Reset**, **Restart System**, **Connection Timeout**, and **Logout**.

TFTP Services

Trivial File Transfer Protocol (TFTP) services allow the Switch firmware to be upgraded by downloading a new firmware file from a TFTP server to the Switch. A configuration file can also be loaded into the Switch, and switch settings can be saved to a TFTP server. In addition, the Switch's history log can be uploaded from the Switch to a TFTP server.

Please note that TFTP server software must be running on the management station for the TFTP services listed here to work.

Update Firmware

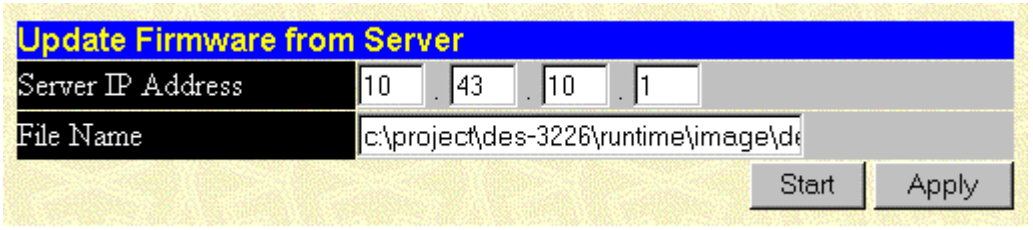


Figure 7-47. Update Firmware from Server window

Enter the IP address of the TFTP Server in the **Server IP Address** field and the complete path and file name of the firmware file for the Switch. Click **Apply** to enter the server's IP address into the Switch's RAM (use Save Changes to enter the address into the Switch's non-volatile RAM). Click **Start** to initiate the file transfer.

The information is described as follows:

- **Server IP Address –** The IP address of the TFTP server.
- **File Name –** The full file name (including path) of the new firmware file on the TFTP server.

Configuration File

A configuration file can be downloaded from a TFTP server to the Switch. This file is then used by the Switch to configure itself.

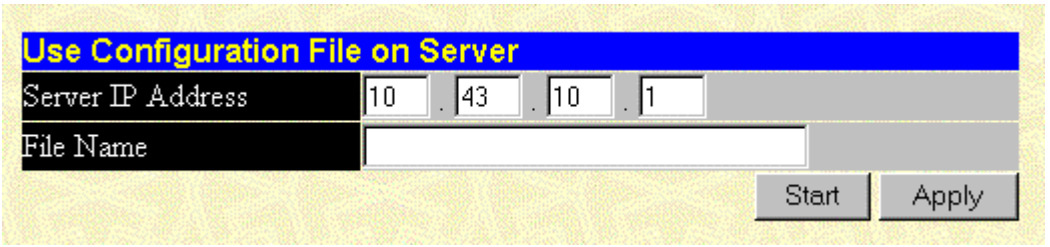


Figure 7-48. Use Configuration File on Server window

Enter the IP address of the TFTP Server in the **Server IP Address** field and the complete path and file name of the firmware file for the Switch. Click **Apply** to enter the server's IP address into the Switch's RAM (use Save Changes to enter the address into the Switch's non-volatile RAM). Click **Start** to initiate the file transfer.

The information is described as follows:

- **Server IP Address –** The IP address of the TFTP server.
- **File Name –** The full file name (including path) of the new firmware file on the TFTP server.

Note: *Configuration files used in the earlier version of this switch (firmware version 1.0) are not supported by the present version (firmware version 2.0). The Switch Information window displays the firmware version.*

Save Settings

The Switch's current settings can be uploaded to a TFTP Server by the Switch's management agent.

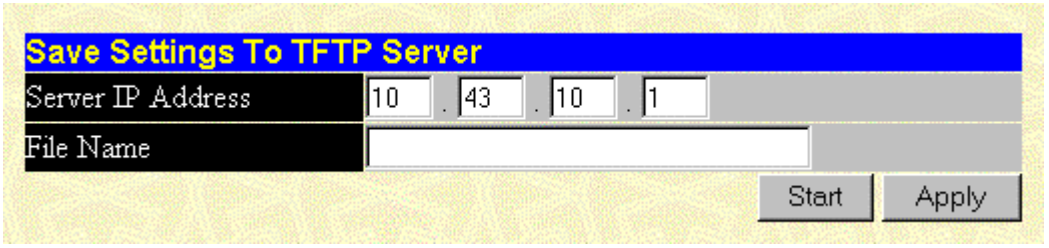


Figure 7-49. Save Settings To TFTP Server window

Enter the IP address of the TFTP Server in the **Server IP Address** field and the complete path and file name of the firmware file for the Switch. Click **Apply** to enter the server's IP address into the Switch's RAM (use Save Changes to enter the address into the Switch's non-volatile RAM). Click **Start** to initiate the file transfer.

Please note that if the user does not save configurations to NV-RAM, the configurations the user is uploading to a TFTP server will not be saved correctly.

The information is described as follows:

- **Server IP Address –** The IP address of the TFTP server.
- **File Name –** The full file name (including path) of the new firmware file on the TFTP server.

Save History Log

The Switch's management agent can upload its history log file to a TFTP server.

Please note that an empty history file on the TFTP server must exist on the server before the Switch can upload its history file.

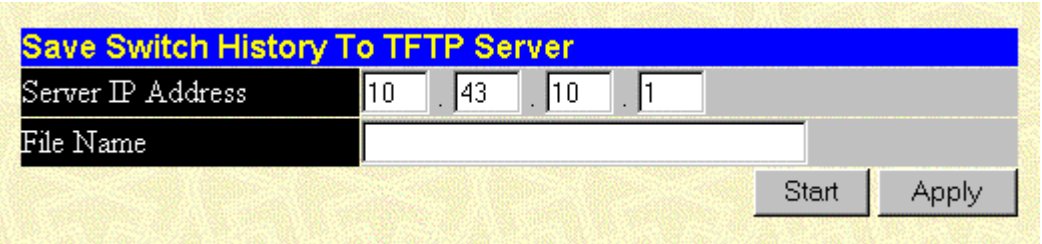


Figure 7-50. Save Switch History To TFTP Server window

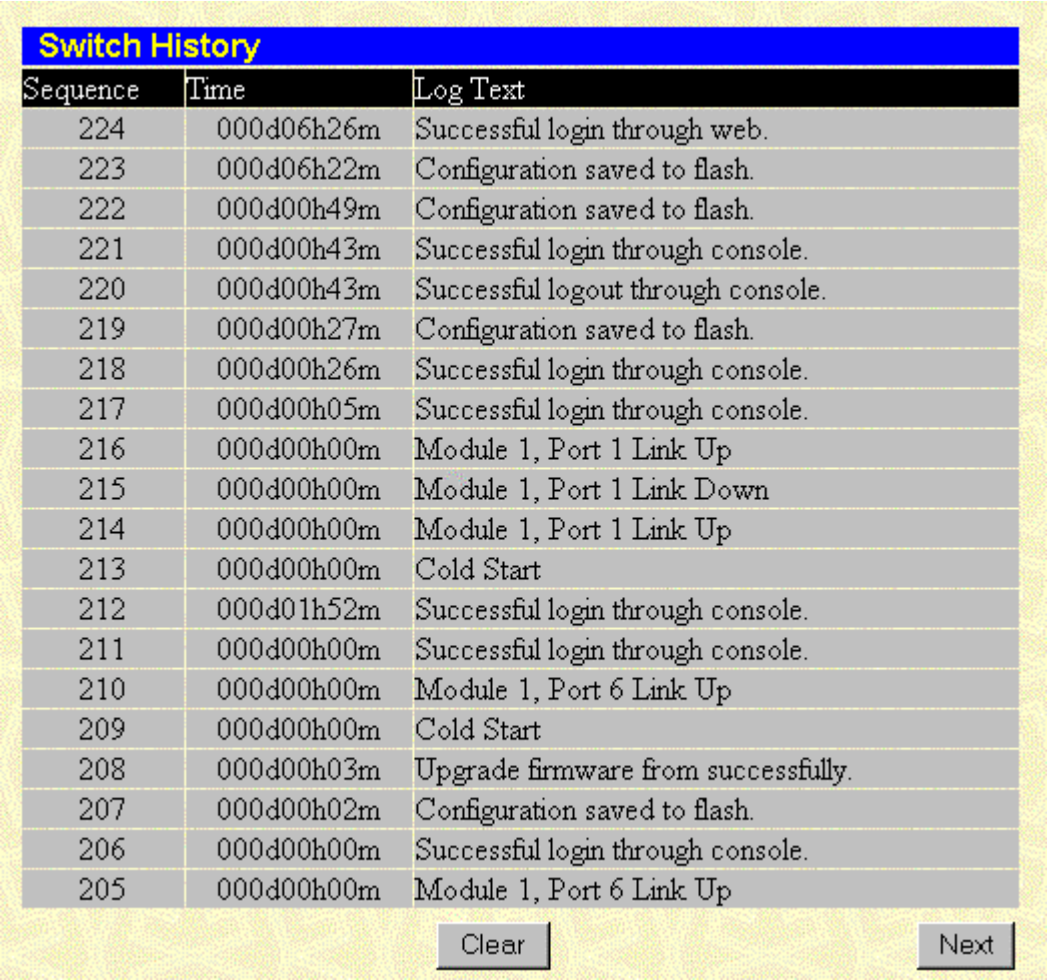
Enter the IP address of the TFTP Server in the **Server IP Address** field and the complete path and file name of the firmware file for the Switch. Click **Apply** to enter the server's IP address into the Switch's RAM (use Save Changes to enter the address into the Switch's non-volatile RAM). Click **Start** to initiate the file transfer.

The information is described as follows:

- **Server IP Address –** The IP address of the TFTP server.
- **File Name –** The full file name (including path) of the new firmware file on the TFTP server.

Switch History

The Web Manager allows the Switch's history log, as compiled by the Switch's management agent, to be viewed.



Switch History

Sequence	Time	Log Text
224	000d06h26m	Successful login through web.
223	000d06h22m	Configuration saved to flash.
222	000d00h49m	Configuration saved to flash.
221	000d00h43m	Successful login through console.
220	000d00h43m	Successful logout through console.
219	000d00h27m	Configuration saved to flash.
218	000d00h26m	Successful login through console.
217	000d00h05m	Successful login through console.
216	000d00h00m	Module 1, Port 1 Link Up
215	000d00h00m	Module 1, Port 1 Link Down
214	000d00h00m	Module 1, Port 1 Link Up
213	000d00h00m	Cold Start
212	000d01h52m	Successful login through console.
211	000d00h00m	Successful login through console.
210	000d00h00m	Module 1, Port 6 Link Up
209	000d00h00m	Cold Start
208	000d00h03m	Upgrade firmware from successfully.
207	000d00h02m	Configuration saved to flash.
206	000d00h00m	Successful login through console.
205	000d00h00m	Module 1, Port 6 Link Up

Clear Next

Figure 7-51. Switch History window

The Switch can record event information in its own logs, to designated SNMP trap receiving stations, and to the PC connected to the console manager. Clicking **Next** at the bottom of the window will allow you to display all the Switch Trap Logs.

The information is described as follows:

- **Sequence –** A counter incremented whenever an entry to the Switch's history log is made. The table displays the last entry (highest sequence number) first.
- **Time –** Displays the time in days, hours, and minutes since the Switch was last restarted.
- **Log Text –** Displays text describing the event that triggered the history log entry.

Ping Test

The Switch is able to test the connection with another network device using Ping.

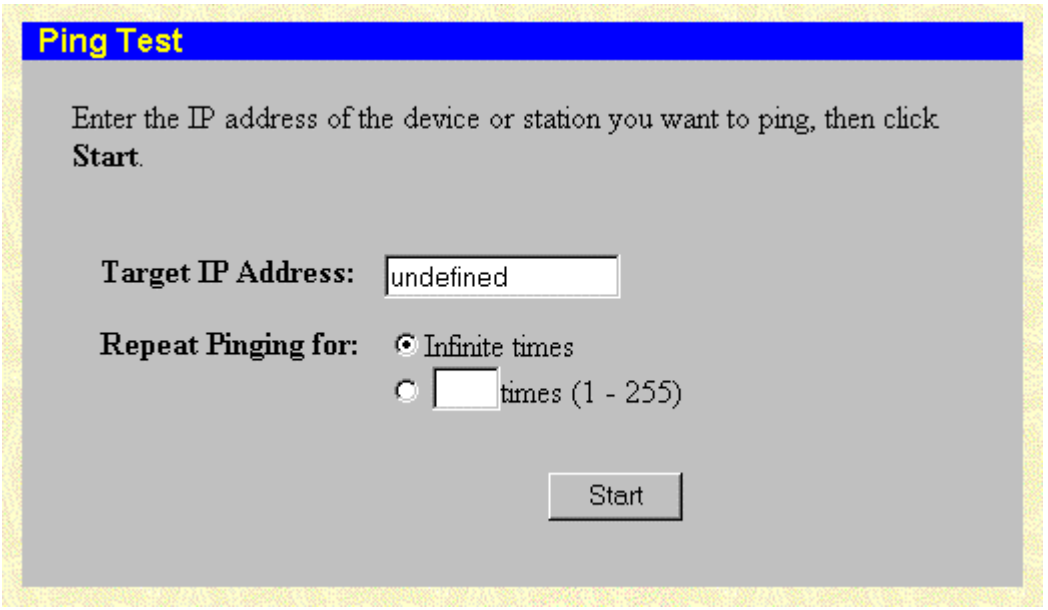

Ping Test
Enter the IP address of the device or station you want to ping, then click Start.
Target IP Address:
undefined
Repeat Pinging for:
Infinite times
times (1 - 255)
Start

Figure 7-52. Ping Test window

Enter the IP address of the network device to be Pinged in the first field and select the number of test packets to be sent (3 is usually enough). Click **Start** to initiate the Ping program.

Save Changes

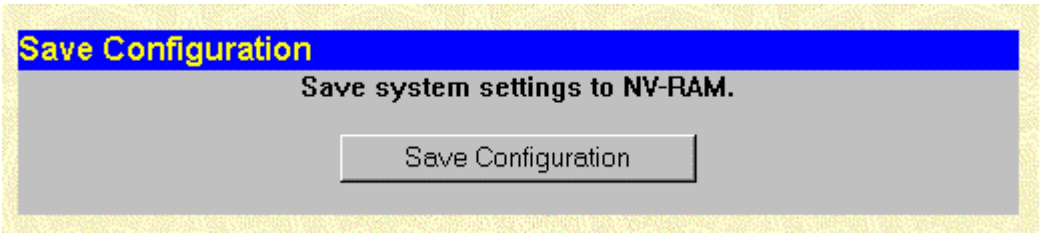


Figure 7-53. Save Configuration window

To save all the changes made in the current session to the Switch's flash memory, click the **Save Configuration** button.

Factory Reset

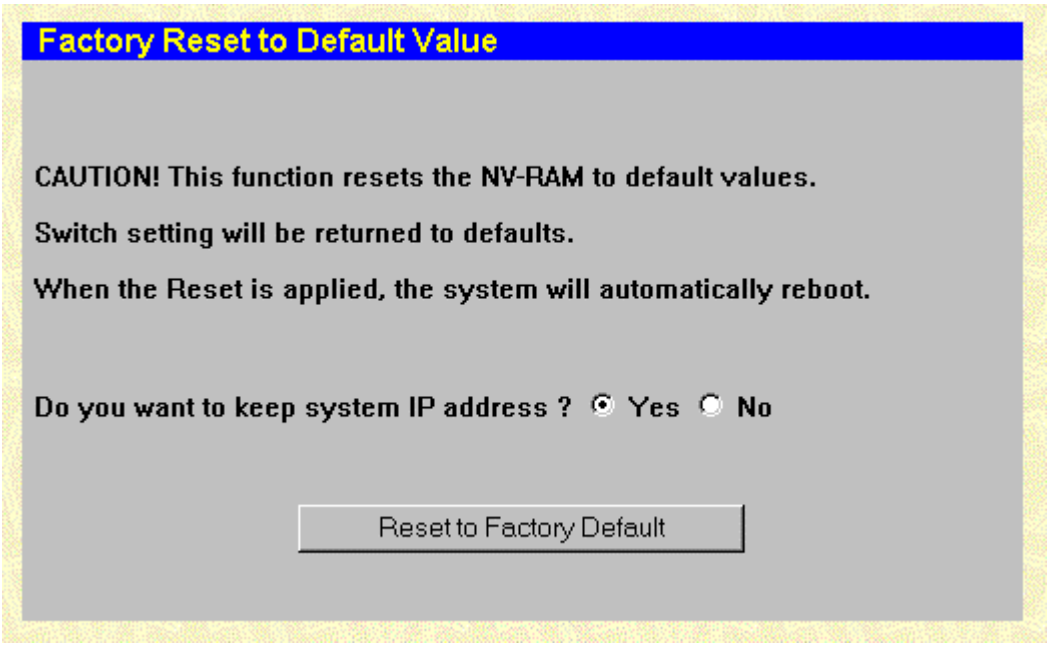

Factory Reset to Default Value
CAUTION! This function resets the NV-RAM to default values.
Switch setting will be returned to defaults.
When the Reset is applied, the system will automatically reboot.
Do you want to keep system IP address ? Yes No
Reset to Factory Default

Figure 7-54. Factory Reset to Default Value window

A remote reset returns the Switch to the initial parameters set at the factory. Click **Reset to Factory Default** to reset the Switch.

Restart System

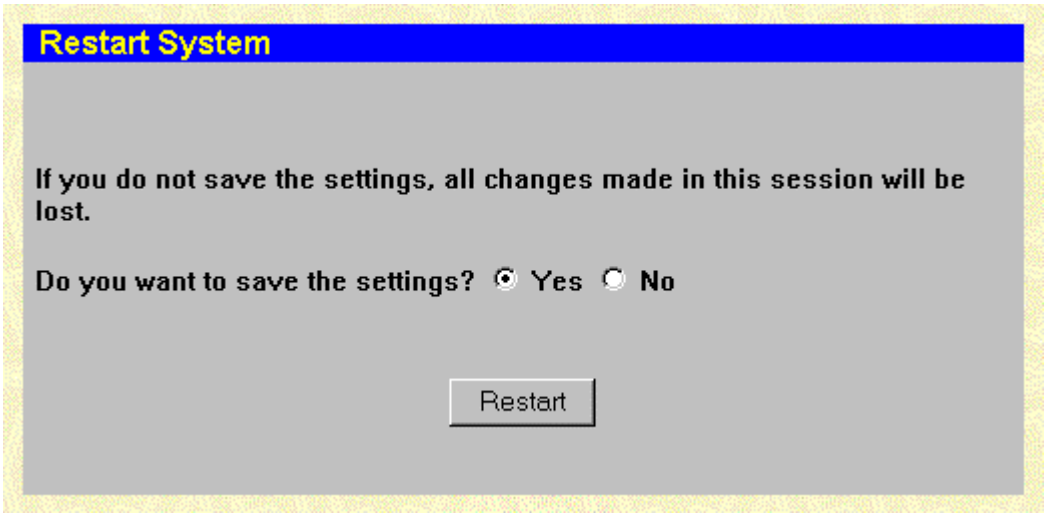

Restart System
If you do not save the settings, all changes made in this session will be lost.
Do you want to save the settings? Yes No
Restart

Figure 7-55. Restart System window

To perform a reboot of the Switch, which resets the system, click the **Restart** button.

Connection Timeout

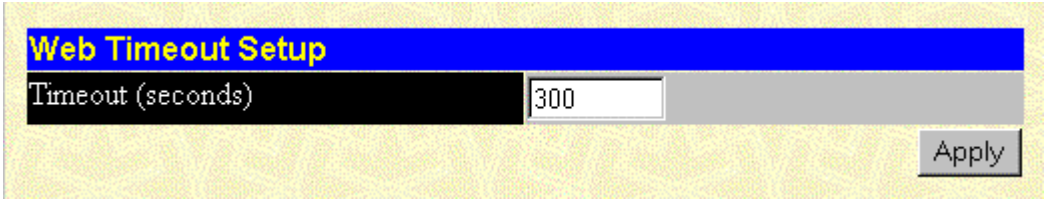


Figure 7-56. Web Timeout Setup window

To use this Web timeout feature, enter the desired age-out time and then click **Apply**.

Logout

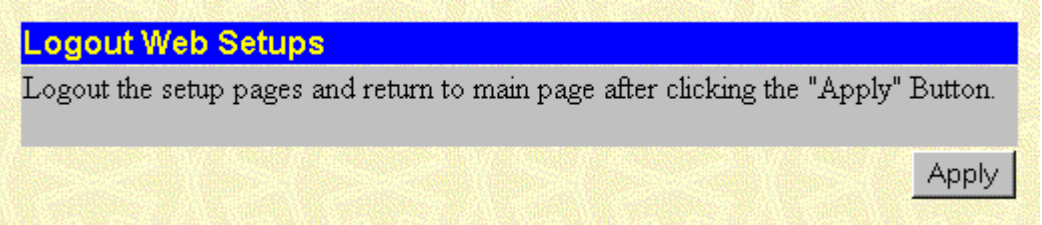


Figure 7-57. Logout Web Setups window

To exit the setup pages and return to the main page, click **Apply**.

Help

Click this button to access the online helpfiles for the Switch.

A

TECHNICAL SPECIFICATIONS

General		
Standards:	IEEE 802.3 10BASE-T Ethernet IEEE 802.3u 100BASE-TX Fast Ethernet IEEE 802.1 Q VLAN IEEE 802.3x Full-duplex Flow Control ANSI/IEEE 802.3 NWay auto-negotiation	
Protocols:	CSMA/CD	
Data Transfer Rates: Ethernet Fast Ethernet	Half-duplex 10 Mbps 100Mbps	Full-duplex 20Mbps 200Mbps
Topology:	Star	
Network Cables: 10BASE-T: 100BASE-TX:	 2-pair UTP Cat. 3, 4, 5 (100 m) EIA/TIA- 568 100-ohm STP (100 m) 2-pair UTP Cat. 5 (100 m) EIA/TIA-568 100-ohm STP (100 m)	
Number of Ports:	24 x 10/100 Mbps NWay ports 1 or 2 100BASE ports or 2 1000BASE ports (optional)	

Physical and Environmental	
AC inputs:	100 - 240 VAC, 50/60 Hz (internal universal power supply)
Power Consumption:	40 watts maximum
DC fans:	2 built-in 40 x 40 x10 mm fan
Operating Temperature:	0 to 50 degrees Celsius
Storage Temperature:	-25 to 55 degrees Celsius
Humidity:	Operating: 5% to 95% RH non-condensing; Storage: 0% to 95% RH non-condensing
Dimensions:	441 mm x 207 mm x 44 mm (1U), 19 inch rack-mount width
Weight:	2.8 kg
EMI:	FCC Class A, CE Class A, VCCI Class A, BSMI Class A, C-Tick Class A
Safety:	UL/CUL, TUV/GS

Performance	
Transmission Method:	Store-and-forward
RAM Buffer:	8 Mbytes per device
Filtering Address Table:	8K
Packet Filtering/ Forwarding Rate:	Full-wire speed for all connections. 148,800 pps per port (for 100Mbps) 1,488,000 pps per port (for 1000Mbps)
MAC Address Learning:	Automatic update.
Forwarding Table Age Time:	Max age:10–1000000 seconds. Default = 300.

B

RJ-45 PIN SPECIFICATION

When connecting the Switch to another switch, a bridge or a hub, a normal cable is necessary. Please review these products for matching cable pin assignment.

The following diagram and table show the standard RJ-45 receptacle/connector and their pin assignments for the switch-to-network adapter card connection, and the normal cable for the Switch-to-switch/hub/bridge connection.

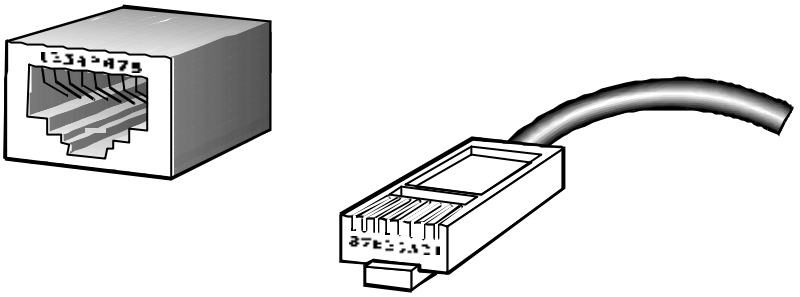


Figure B-1. The standard RJ-45 receptacle/connector

RJ-45 Connector pin assignment	
Contact	Media Direct Interface Signal
1	Tx + (transmit)
2	Tx - (transmit)
3	Rx + (receive)
4	Not used
5	Not used
6	Rx - (receive)
7	Not used
8	Not used

Table B-1. The standard Category 3 cable, RJ-45 pin assignment

The following shows straight cable and crossover cable connection:

C

RUNTIME SWITCHING SOFTWARE DEFAULT SETTINGS

Load mode	Ethernet
Configuration update	Disable
Firmware update	Disable
Out-of-band baud rate	9600
RS232 mode	Console
IP address	10.90.90.90
Subnet mask	255.0.0.0
Default gateway	0.0.0.0
BootP service	Disable
TFTP server IP address	0.0.0.0
Auto log-out	10 min
User name	None
Password	None
MAC address aging time	300 secs
IGMP snooping	Disable
Switch GVRP	Disable
Telnet status	Enable
Web status	Enable
Device STP	Disable
Port STP	Enable
Port enable	Enable
Group address filter mode	Forward all unregistered
Scheduling mechanism for COS queues	Strict
Trunk load sharing algorithm	Src address
Bridge max age	20 secs
Bridge hello time	2 secs
Bridge forward delay	15 secs
Bridge priority	32768
Port STP cost	100
Port STP priority	128
Nway	Enable
Flow control	Enable
Community string	"public", "private"
VLAN mode	IEEE 802.1Q
Management VLAN ID	1
Default port VID	1
Ingress rule checking	Disable

D

UNDERSTANDING AND TROUBLESHOOTING THE SPANNING TREE PROTOCOL

When the spanning-tree algorithm determines a port should be transitioned to the forwarding state, the following occurs:

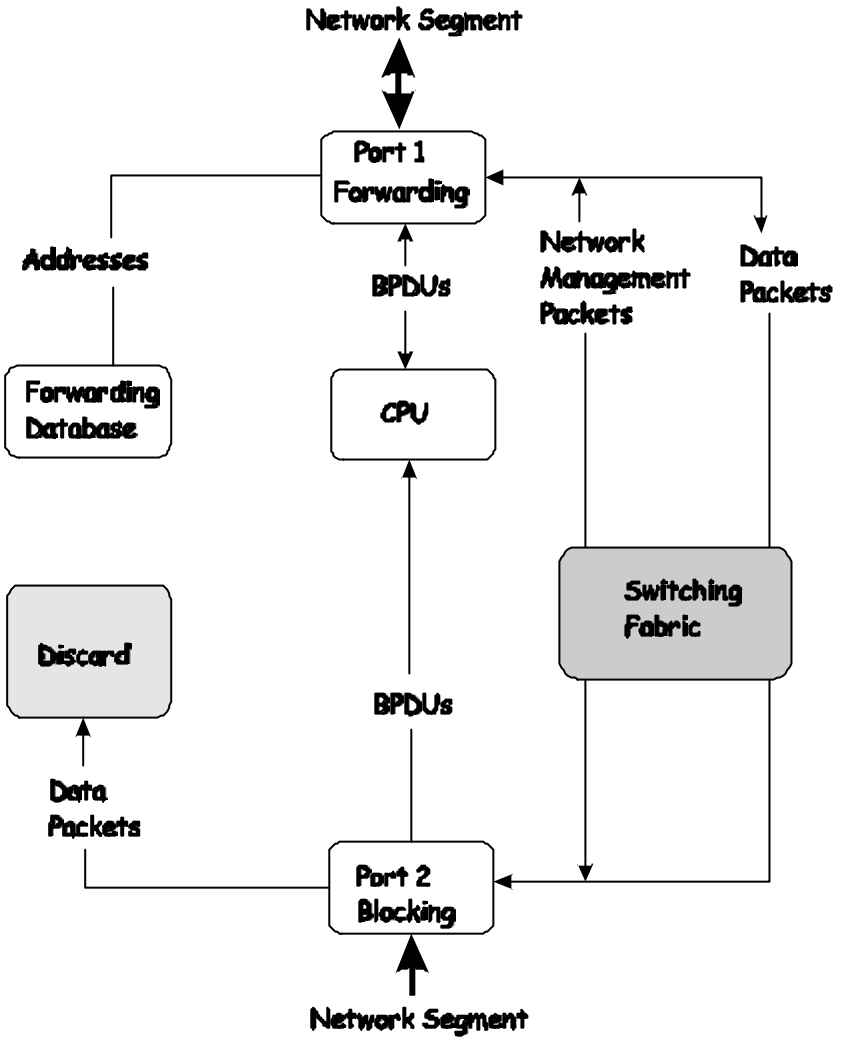
- The port is put into the listening state where it receives BPDUs and passes them to the switch's CPU. BPDU packets from the CPU are processed. If no BPDUs that suggest the port should go to the blocking state are received:
- The port waits for the expiration of the forward delay timer. It then moves to the learning state.
- In the learning state, the port learns station location information from the source address of packets and adds this information to its forwarding database.
- The expiration of forwarding delay timer moves the port to the forwarding state, where both learning and forwarding are enabled. At this point, packets are forwarded by the port.

Blocking State

A port in the blocking state does not forward packets. When the switch is booted, a BPDU is sent to each port in the switch putting these ports into the blocking state. A switch initially assumes it is the root, and then begins the exchange of BPDUs with other switches. This will determine which switch in the network is the best choice for the root switch. If there is only one switch on the network, no BPDU exchange occurs, the forward delay timer expires, and the ports move to the listening state. All STP enabled ports enter the blocking state following switch boot.

A port in the blocking state does the following:

- Discards packets received from the network segment to which it is attached.
- Discards packets sent from another port on the switch for forwarding.
- Does not add addresses to its forwarding database
- Receives BPDUs and directs them to the CPU.
- Does not transmit BPDUs received from the CPU.
- Receives and responds to network management messages.



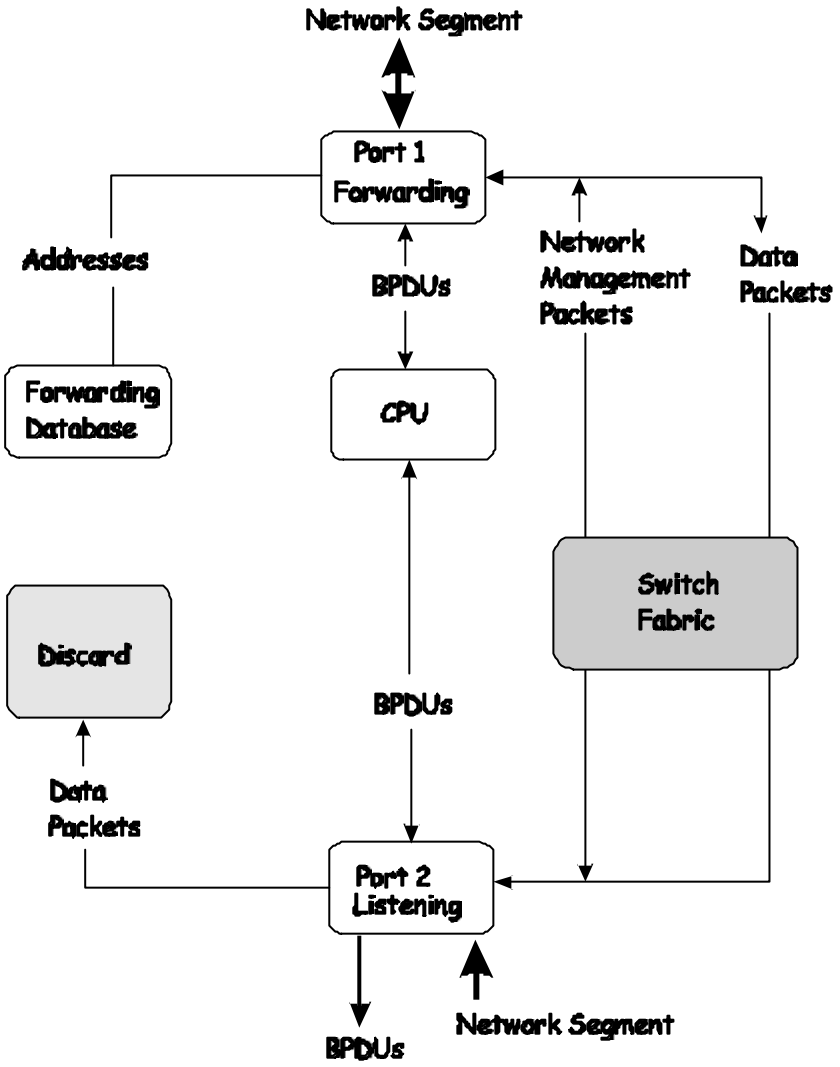
Listening State

The listening state is the first transition for a port from the blocking state. Listening is an opportunity for the switch to receive BPDUs that may tell the switch that the port should not continue to transition to the forwarding state, but should return to the blocking state (that is, a different port is a better choice).

There is no address learning or packet forwarding from a port in the listening state.

A port in the listening state does the following:

- Discards frames received from the network segment to which it is attached.
- Discards packets sent from another port on the switch for forwarding.
- Does not add addresses to its forwarding database
- Receives BPDUs and directs them to the CPU.
- Processes BPDUs received from the CPU.
- Receives and responds to network management messages.

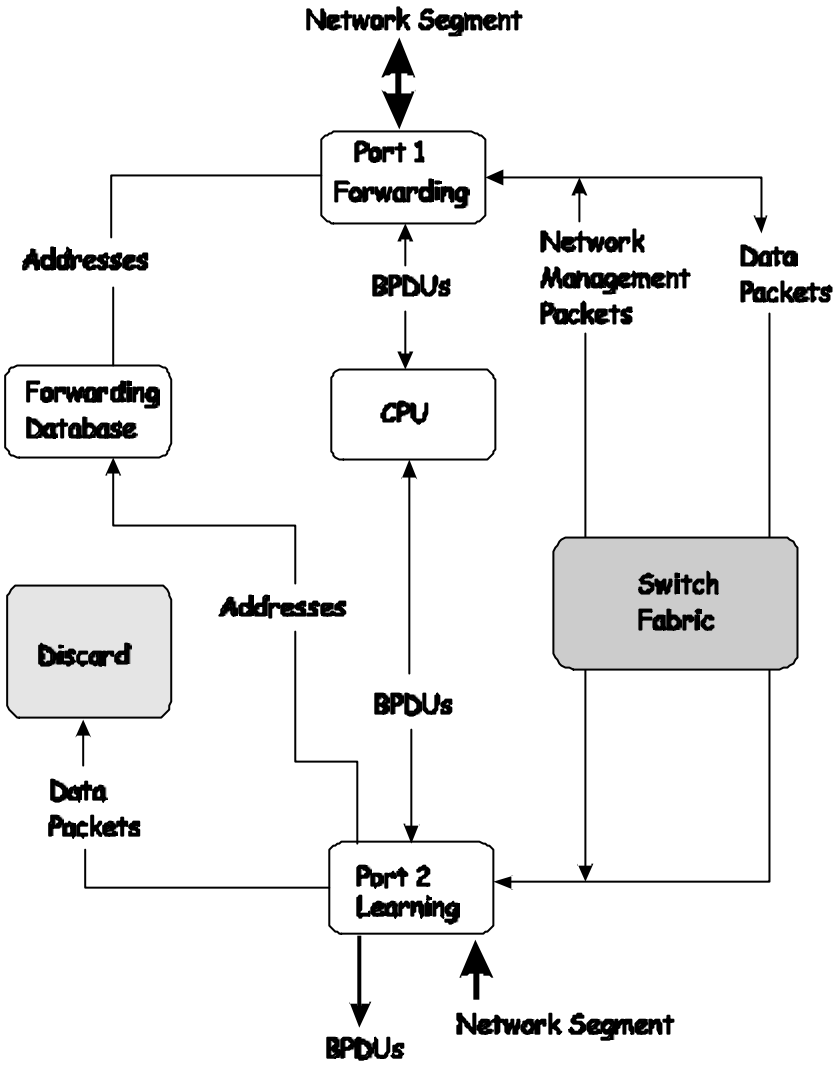


Learning State

A port in the learning state prepares to participate in frame forwarding. The port enters the learning state from the listening state.

A port in the learning state does the following:

- Discards frames received from the network segment to which it is attached.
- Discards packets sent from another port on the switch for forwarding.
- Adds addresses to its forwarding database.
- Receives BPDUs and directs them to the CPU.
- Processes and transmits BPDUs received from the CPU.
- Receives and responds to network management messages.

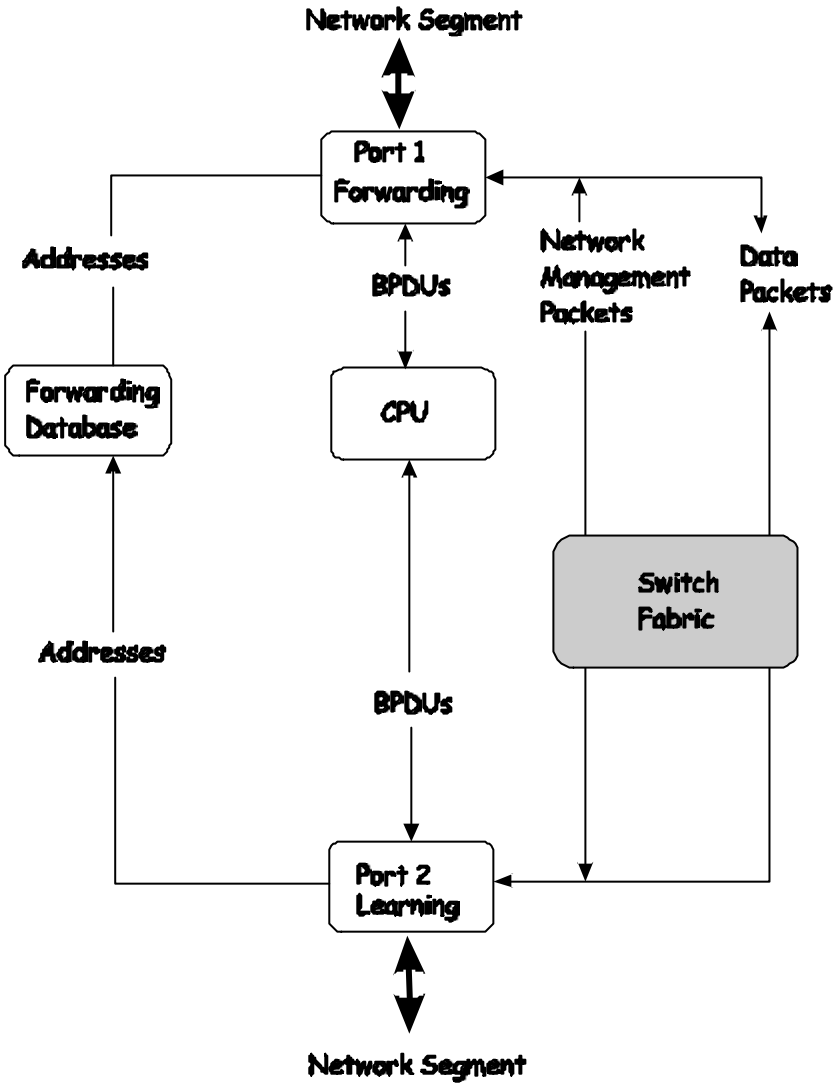


Forwarding State

A port in the forwarding state forwards packets. The port enters the forwarding state from the learning state when the forward delay timer expires.

A port in the forwarding state does the following:

- Forwards packets received from the network segment to which it is attached.
- Forwards packets sent from another port on the switch for forwarding.
- Incorporates station location information into its address database.
- Receives BPDUs and directs them to the system CPU.
- Receives and responds to network management messages.

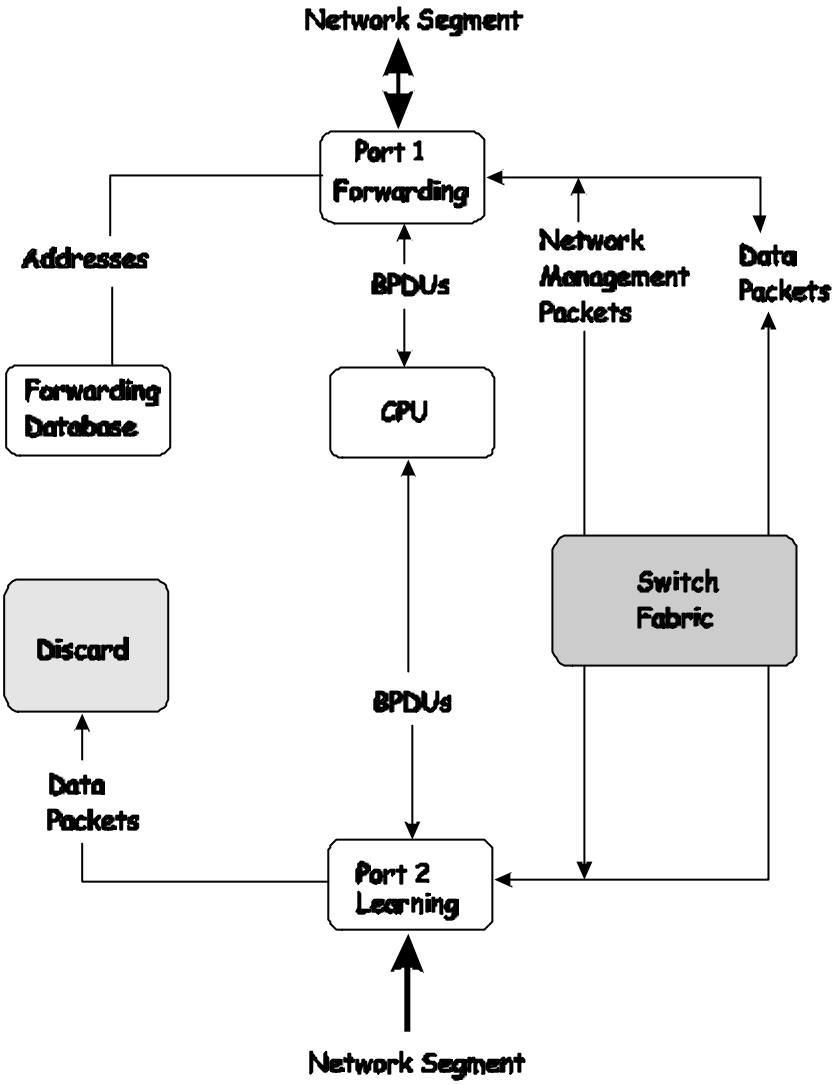


Disabled State

A port in the disabled state does not participate in frame forwarding or STP. A port in the disabled state is virtually non-operational.

A disabled port does the following:

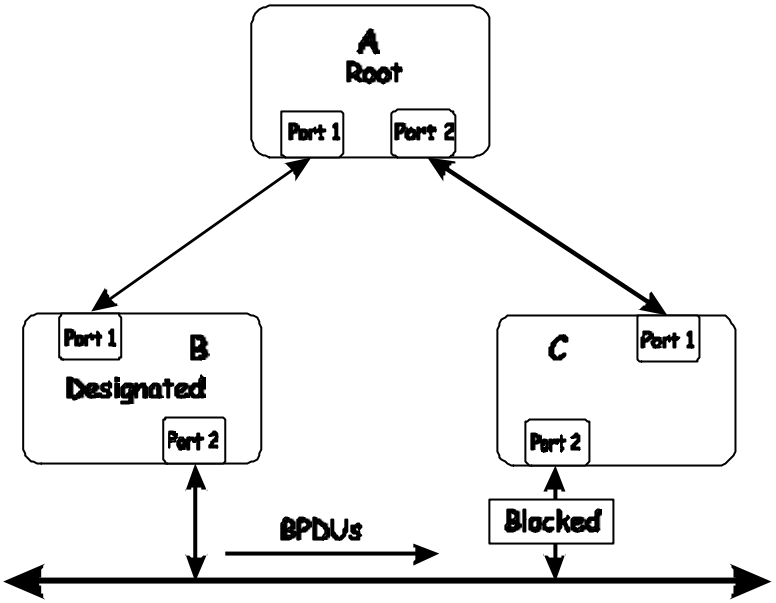
- Discards packets received from the network segment to which it is attached.
- Discards packets sent from another port on the switch for forwarding.
- Does not add addresses to its forwarding database.
- Receives BPDUs, but does not direct them to the system CPU.
- Does not receive BPDUs for transmission from the system CPU.
- Receives and responds to network management messages.



Troubleshooting STP

Spanning Tree Protocol Failure

A failure in the STA generally leads to a bridging loop. A bridging loop in an STP environment comes from a port that should be in the blocking state, but is forwarding packets.



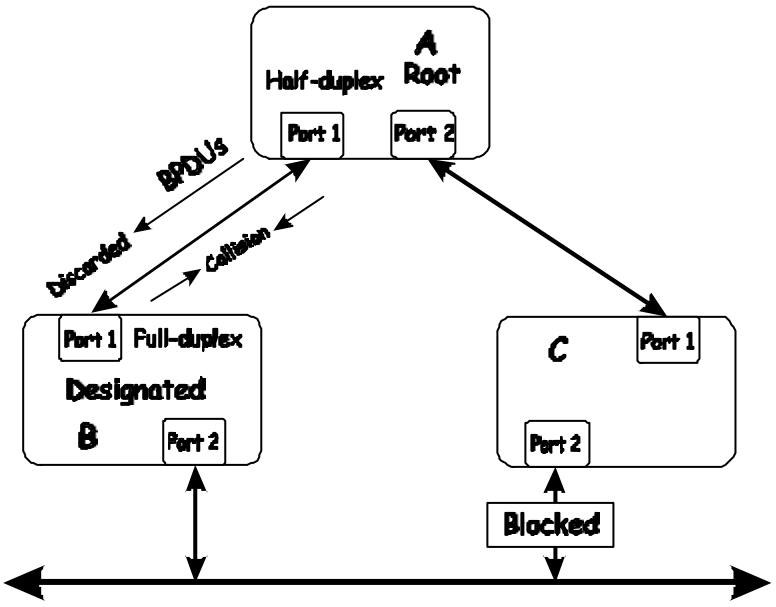
In this example, B has been elected as the designated bridge and port 2 on C is in the blocking state. The election of B as the designated bridge is determined by the exchange of BPDUs between B and C. B had a better BPDU than C. B continues sending BPDUs advertising its superiority over the other bridges on this LAN. Should C fail to receive these BPDUs for longer than the MAX AGE (default of 20 seconds), it could start to transition its port 2 from the blocking state to the forwarding state.

It should be noted: A port must continue to receive BPDUs advertising superior paths to remain in the blocking state.

There are a number of circumstances in which the STA can fail – mostly related to the loss of a large number of BPDUs. These situations will cause a port in the blocking state to transition to the forwarding state.

Full/Half Duplex Mismatch

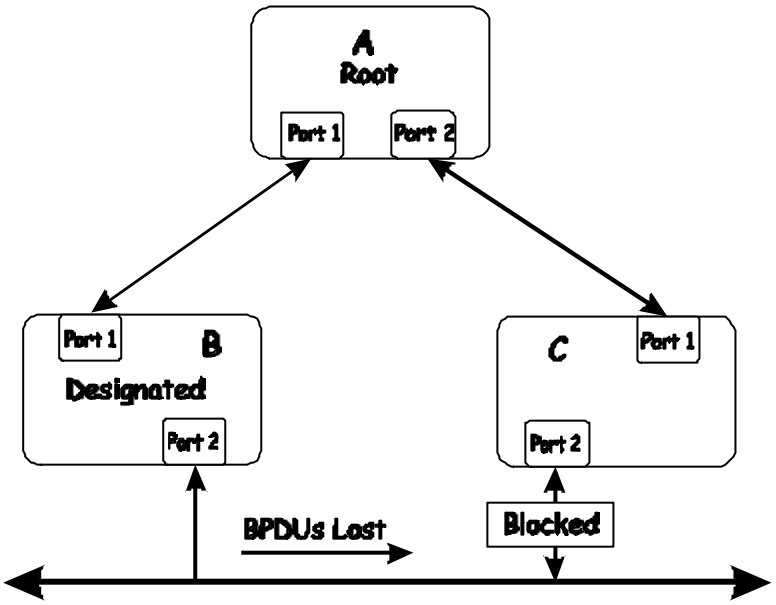
A mismatch in the duplex state of two ports is a very common configuration error for a point-to-point link. If one port is configured as a full duplex, and the other port is left in auto-negotiation mode, the second port will end up in half-duplex because ports configured as half- or full-duplex do not negotiate.



In the above example, port 1 on B is configured as a full-duplex port and port 1 on A is either configured as a half-duplex port, or left in auto-negotiation mode. Because port 1 on B is configured as a full-duplex port, it does not do the carrier sense when accessing the link. B will then start sending packets even if A is using the link. A will then detect collisions and begin to run the flow control algorithm. If there is enough traffic between B and A, all packets (including BPDUs) will be dropped. If the BPDUs sent from A to B are dropped for longer than the MAX AGE, B will lose its connection to the root (A) and will unblock its connection to C. This will lead to a data loop.

Unidirectional Link

Unidirectional links can be caused by an undetected failure in one side of a fiber cable, or a problem with a ports transceiver. Any failure that allows a link to remain up while providing one-way communication is very dangerous for STP.



In this example, port 2 on B can receive but not transmit packets. Port 2 on C should be in the blocking state, but since it can no longer receive BPDUs from port 2 on B, it will transition to the forwarding state. If the failure exists at boot, STP will not converge and rebooting the bridges will have no effect. (Note: Rebooting would help temporarily in the previous example).

This type of failure is difficult to detect because the Link-state LEDs for Ethernet links rely on the transmit side of the cable to detect a link. If a unidirectional failure on a link is suspected, it is usually required to go to the console or other management software and look at the packets received and transmitted for the port. A unidirectional port will have many packets transmitted but none received, or vice versa, for example.

Packet Corruption

Packet corruption can lead to the same type of failure. If a link is experiencing a high rate of physical errors, a large number of consecutive BPDUs can be dropped and a port in the blocking state would transition to the forwarding state. The blocking port would have to have the BPDUs dropped for 50 seconds (at the default settings) and a single BPDU would reset the timer. If the MAX AGE is set too low, this time is reduced.

Resource Errors

The DES-3226 performs its switching and routing functions primarily in hardware, using specialized ASICs. STP is implemented in software and is thus reliant upon the speed of the CPU and other factors to converge. If the CPU is over-

utilized, it is possible that BPDUs may not be sent in a timely fashion. STP is generally not very CPU intensive and is given priority over other processes, so this type of error is rare.

It can be seen that very low values for the MAX AGE and the FORWARD DELAY can result in an unstable spanning tree. The loss of BPDUs can lead to data loops. The diameter of the network can also cause problems. The default values for STP give a maximum network diameter of about seven. This means that two switches in the network cannot be more than seven hops apart. Part of this diameter restriction is the BPDU age field. As BPDUs are propagated from the root bridge to the leaves of the spanning tree, each bridge increments the age field. When this field is beyond the maximum age, the packet is discarded. For large diameter networks, STP convergence can be very slow.

Identifying a Data Loop

Broadcast storms have a very similar effect on the network to data loops, but broadcast storm controls in modern switches have (along with subnetting and other network practices) have been very effective in controlling broadcast storms. The best way to determine if a data loop exists is to capture traffic on a saturated link and check if similar packets are seen multiple times.

Generally, if all the users of a given domain are having trouble connecting to the network at the same time, a data loop can be suspected. The port utilization data in the switch's console will give unusually high values in this case.

The priority for most cases is to restore connectivity as soon as possible. The simplest remedy is to manually disable all of the ports that provide redundant links. Disabling ports one at a time, and then checking for a restoration of the user's connectivity will identify the link that is causing the problem, if time allows. Connectivity will be restored immediately after disabling a data loop.

Avoiding Trouble

Know where the root is located.

Although the STP can elect a root bridge, a well-designed network will have an identifiable root for each VLAN. Careful setup of the STP parameters will lead to the selection of this best switch as the root for each VLAN. Redundant links can then be built into the network. STP is well suited to maintaining connectivity in the event of a device failure or removal, but is poorly suited to designing networks.

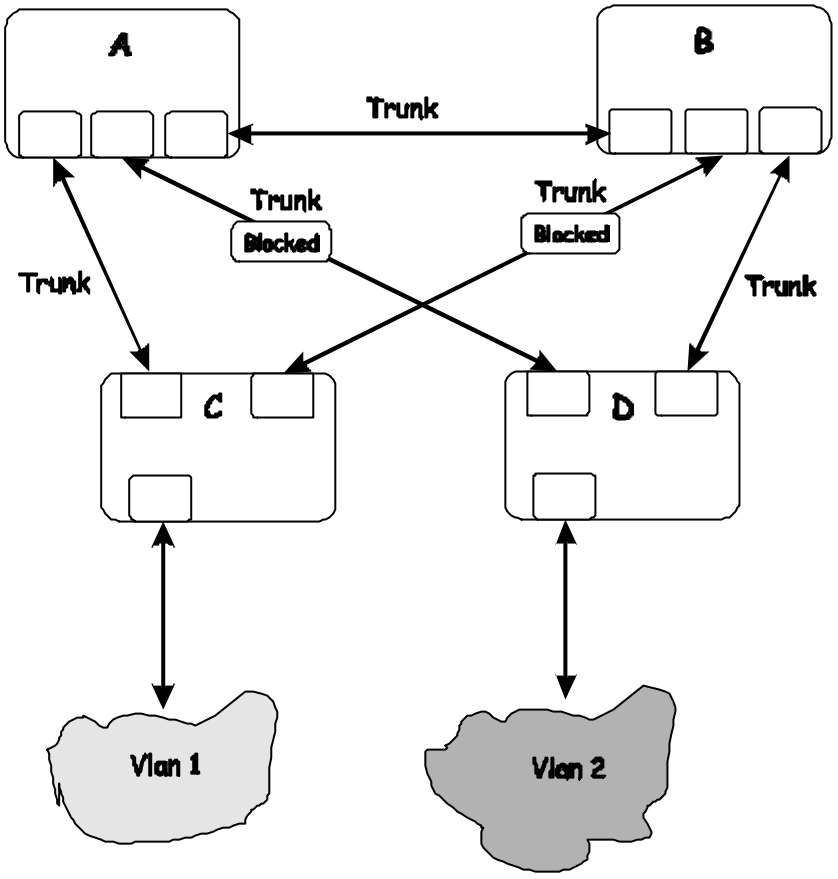
Know which links are redundant.

Organize the redundant links and tune the port cost parameter of STP to force those ports to be in the blocking state.

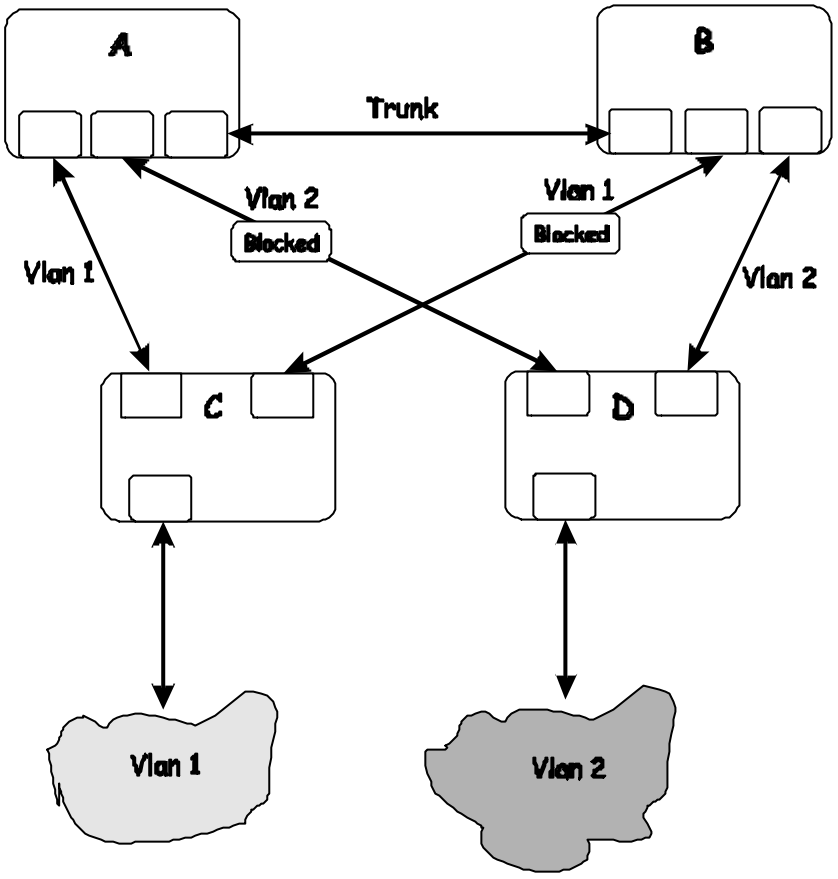
For each VLAN, know which ports should be blocking in a stable network. A network diagram that shows each physical loop in the network and which ports break which loops is extremely helpful.

Minimize the number of ports in the blocking state.

A single blocking port transitioning to the forwarding state at an inappropriate time can cause a large part of a network to fail. Limiting the number of blocked ports help to limit the risk of an inappropriate transition.



This is a common network design. The switches C and D have redundant links to the backbone switches A and B using trunks. Trunks, by default, carry all the VLAN traffic from VLAN 1 and VLAN 2. So switch C is not only receiving traffic for VLAN 1, but it is also receiving unnecessary broadcast and multicast traffic for VLAN 2. It is also blocking one port for VLAN 2. Thus, there are three redundant paths between switches A and B and two blocked ports per VLAN. This increases the chance of a data loop.



In this example, the VLAN definitions are extended to switches A and B. This gives only a single blocked port per VLAN and allows the removal of all redundant links by removing switch A or B from the network.

E

BRIEF REVIEW OF BITWISE LOGICAL OPERATIONS

AND

The logical AND operation compares 2 bits and if they are both "1", then the result is "1", otherwise, the result is "0".

	0	***1***
0	0	0
1	0	1

OR

The logical OR operation compares 2 bits and if either or both bits are "1", then the result is "1", otherwise, the result is "0".

	0	***1***
0	0	1
1	1	1

XOR

The logical XOR (exclusive OR) operation compares 2 bits and if exactly one of them is a "1", then the result is "1", otherwise the result is "0".

	0	***1***
0	0	1
1	1	0

NOT

The logical NOT operation simply changes the value of a single bit. If it is a "1", the result is "0", if it is a "0", the result is "1". This operation is carried out on a single bit.

0	***1***
1	0

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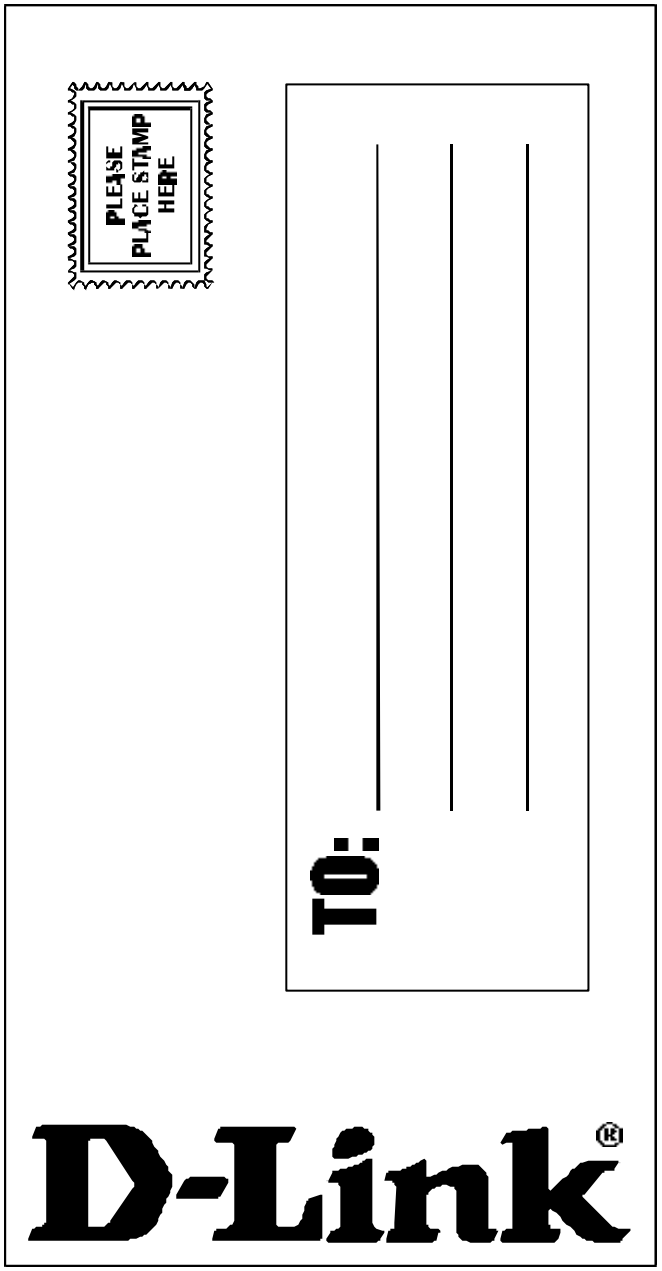
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